American Machinist

McGRAW HILL MAGAZINE OF METALWORKING PRODUCTION

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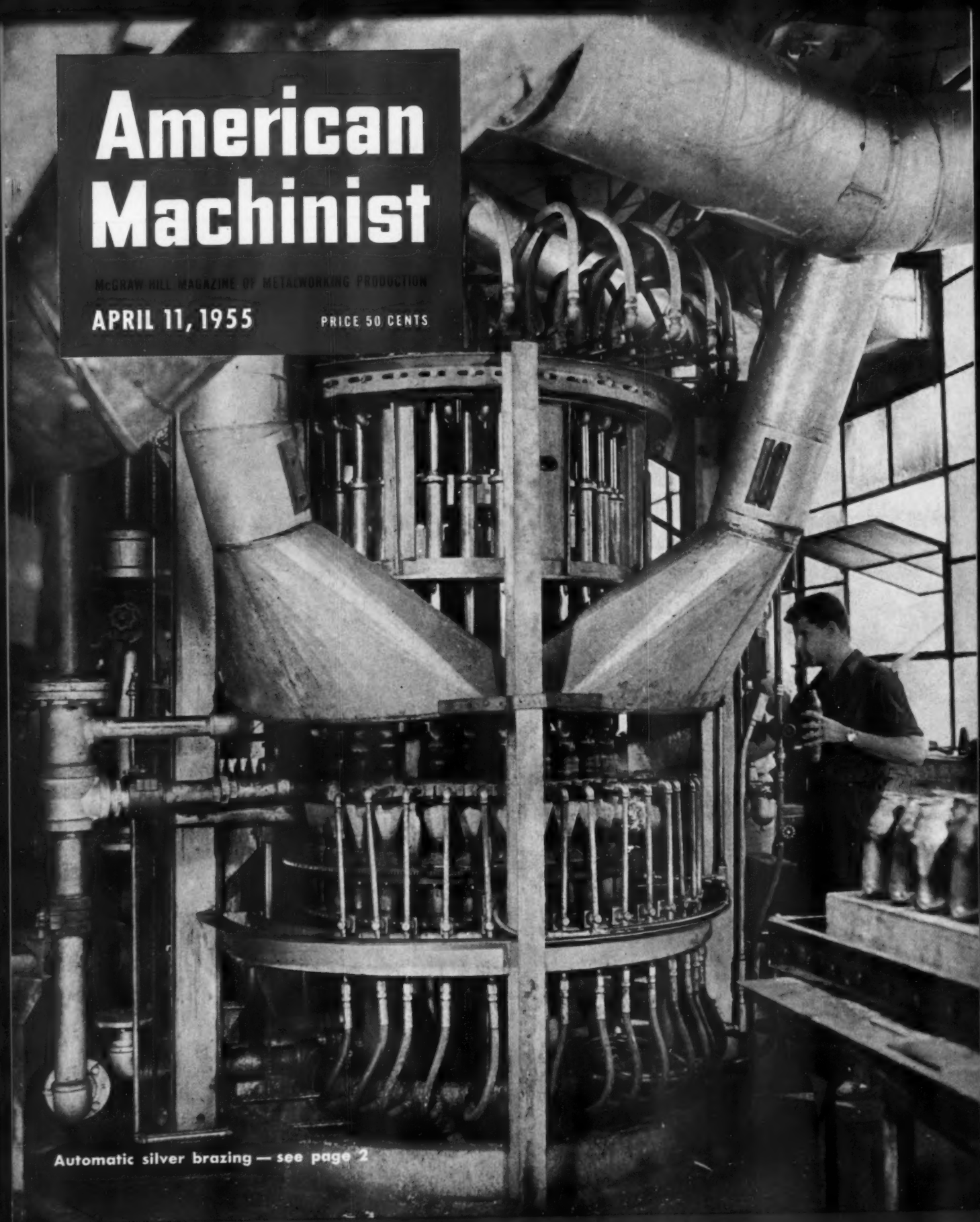
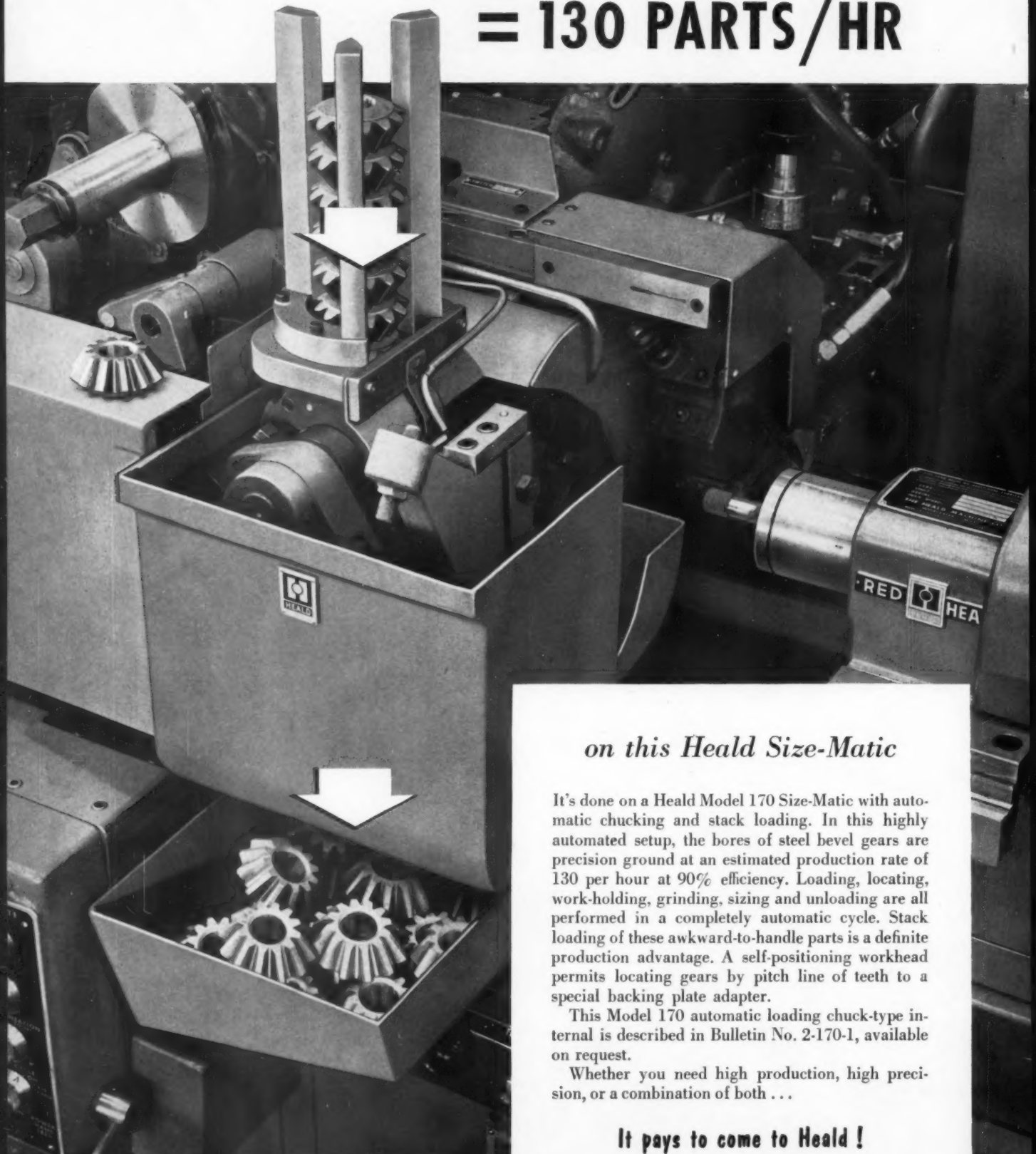


Automatic silver brazing — see page 2

Linear Programming—A SPECIAL REPORT

stack loading + auto-chucking = 130 PARTS/HR



on this Heald Size-Matic

It's done on a Heald Model 170 Size-Matic with automatic chucking and stack loading. In this highly automated setup, the bores of steel bevel gears are precision ground at an estimated production rate of 130 per hour at 90% efficiency. Loading, locating, work-holding, grinding, sizing and unloading are all performed in a completely automatic cycle. Stack loading of these awkward-to-handle parts is a definite production advantage. A self-positioning workhead permits locating gears by pitch line of teeth to a special backing plate adapter.

This Model 170 automatic loading chuck-type internal is described in Bulletin No. 2-170-1, available on request.

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chips

SUPER-BAZOOKA HEAD . . . S W Farber Company, Bronx, NY, makes parts for the HEAT 3.5-in rocket, better known as the super-bazooka. Parts are assembled by automatic silver brazing in Selas gradiation machines like that pictured on our cover. Shown is the machine which brazes a copper cone inside a deep-drawn steel shell; the second brazes the two halves of the head with a sheet-metal partition for a smoke rocket. Each machine has a continuous-running dial feed with 28 stations, each with pressure-application devices to hold parts tightly together during brazing, is 6 ft in dia, produces 750 assemblies per hr. About 3 cfh of natural gas is required per head. Gas is fully premixed with air in a Selas combustion controller, then delivered to a semi-circular manifold of opposed-firing ribbon refractory burners covering about 120° of dial rotation, and into special internal burners which are automatically dropped into the open rear end of the assembly to heat the inside of the joint intensely. Air is forced into another manifold for quick cooling of brazed joints, and there is an automatic internal quench-wash system which cools down rocket heads so they can be removed and washes excess flux from inside.

METROLOGY . . . Charles Minaire, of St Etienne National Armory, France, describes some ingenious methods for gaging tapers, inside and outside, plus some unusual uses for sine bars for linear measurements. The story makes an exceptional lead article in this issue.

LINEAR PROGRAMMING . . . Here is a "hot" and controversial subject, so we've gone to Robert Ferguson, of Methods Engrg Council (see biog) to get you a roundup. It totals 16 pages, with case studies.

TOOLING . . . In addition to our lead article, we have three articles of special interest to tool engineers. The first, by J J Durnan of Behr-Manning, shows seven tricky low-cost fixtures at W & L E Gurley, Troy, NY, for short runs on transit parts. Accuracies to 0.0002 or 0.0005 in. are attained on some . . . Second is a single page on automatic sizing . . . Third is another in Stanley Cope's series on draw dies.

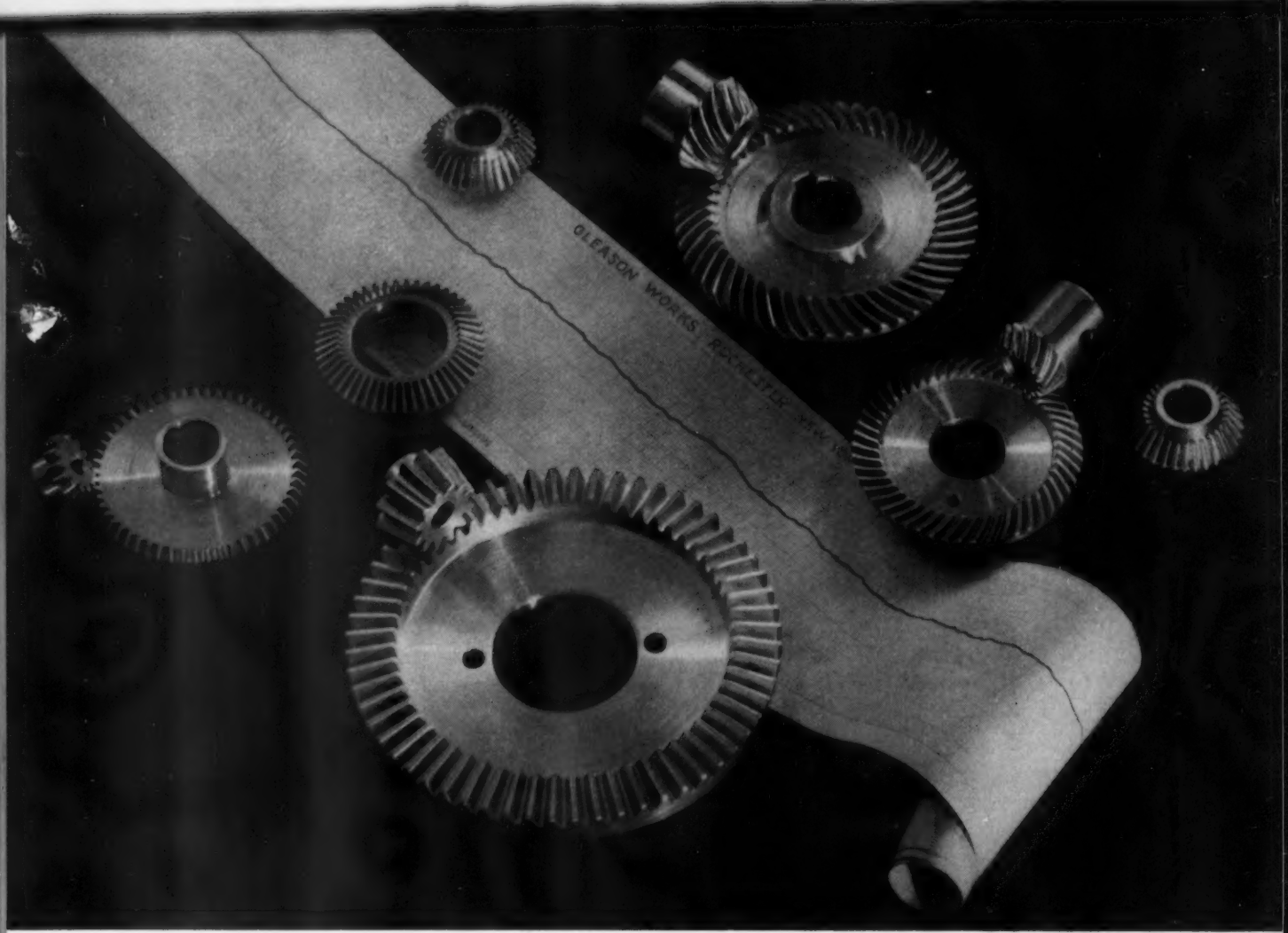
ULTRASONICS . . . Last issue, we showed a new ultrasonic test setup; in this one we have pictures and descriptions of cutting difficult contours and close-tolerance holes in draw dies, gages, precision parts, and ceramics.

MACHINING TI . . . Norman Zlatin, of Metcut Research Associates, tells how to machine 3A1-5Cr titanium, as a result of his research. Here's the latest on a tricky material.

QUENCH OIL . . . Roy F Kern, metallurgist at Allis-Chalmers, Springfield, Ill, describes a new automatic heat-treat system for tractor shoes, particularly the matter of cleaning and cooling quench oil to cut costs and improve quality. Maintenance costs dropped 90%, and only half as much oil is used.

COMING . . . *AM* for April 25 will describe the changes shop men made in the C & O Shops at Huntington, W Va; will have articles on soft dies for plastics, management training, planning plant overhaul, and several other subjects we'd like to surprise you with.

L P MAN . . . Robert O Ferguson is a principal in the Methods Engrg Council, Pittsburgh. He has his BS in Management Engrg from Carnegie Tech, and a business administration degree from Pittsburgh, where he majored in personnel. He was a laborer in the open hearth and on various other jobs, ending up as asst foreman in the cold-strip mill while going to Carnegie. Following a lieutenancy in the Air Force, he went back as cold-strip foreman, then entered industrial engrg. In 1948 he became personnel mgr of a steel-fabrication plant, then chief industrial engineer. Since 1950, he has been with MEC. His experience with linear programming is in this issue.



For *better* fine pitch gears . . .

Gleason Works now offers complete production and testing facilities for *any* fine pitch spiral, bevel, hypoid, Zerol® or Coniflex® gears.

Bevel gears produced and tested with Gleason equipment assure the highest degree of accuracy obtainable in angular motion transmission. And, with the new methods and improved design incorporated in these Gleason machines, fine pitch gears can be produced at a lower cost than ever before!

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Three Gleason Generators cover the entire field of cut fine pitch bevel gears up to 4½″ diameter. These include the No. 2, 103 Straight Bevel Coniflex Generators, and the No. 2 Hypoid Generator. All three are automatic machines for jobbing or high-speed production and will improve quality besides increasing production.

For the ultimate in durability and accuracy, hardened fine pitch bevel gears are ground in the No. 105 Straight Bevel Coniflex Grinder or the No. 7 Hypoid Grinder. These Grinders are completely automatic wet-type, high-speed machines.

In gear manufacturing, testing is just as important as the actual gear cutting or grinding. One Gleason Tester—the No. 104 Hypoid Tester—checks the running qualities, tooth spacing and concentricity of gears up to 4¼″ diameter.

An important new feature of the No. 104 is the provision for recording the rolling test on paper, giving a permanent record of the total composite error. An electronic pickup head for a recorder is furnished, and the recorder itself may be engaged or disengaged, as required.

Engineering services available

Cutter sharpeners and complete tooling are available to suit your requirements. In addition, the services of the Gleason Engineering Department are at your disposal, at no obligation to determine the best fine pitch gears for your application and the machinery required to produce them. Write for further information.

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THREE BIG ADVANTAGES

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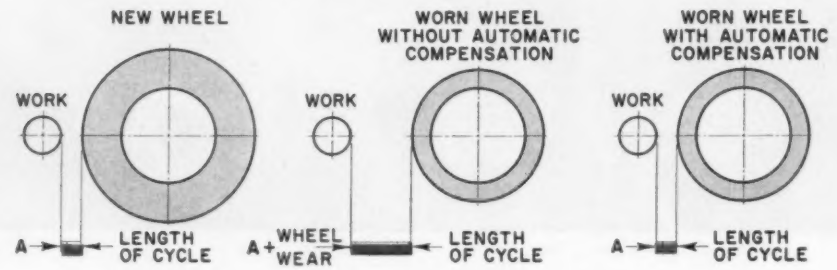
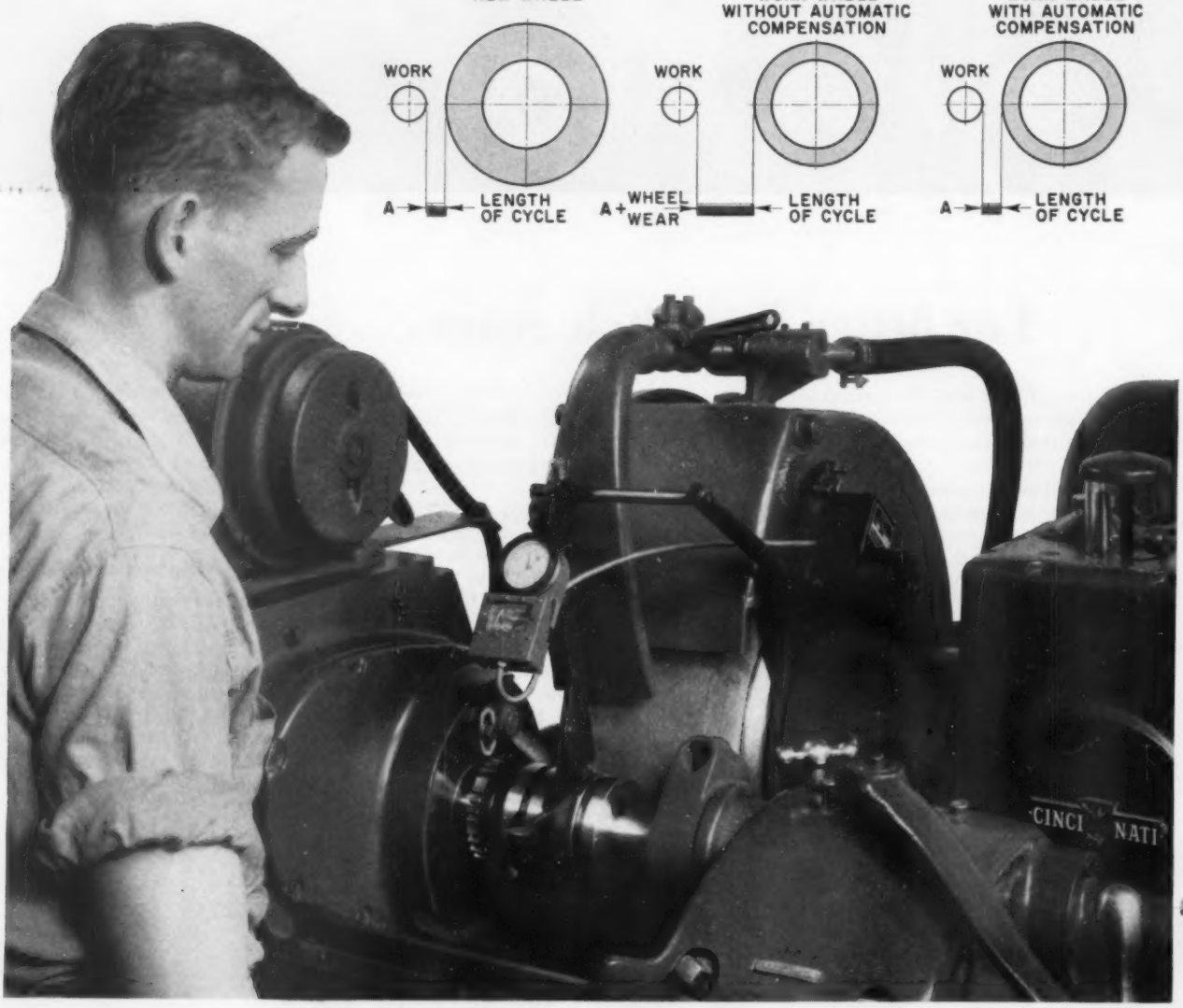
INFEED CYCLE FOR PRODUCTION GRINDING





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1. **Consistently high quality of sizing and finish . . . hand adjustments eliminated.**
2. **Consistently high rate of production hour after hour.**
3. **Operator responsibility reduced.**

CINCINNATI Automatic Electric Gage Sizing pins responsibility for quality and rate of production right where it belongs . . . on the machine. It gives you extra assurance of repetitive tolerances within the closest limits desired. In addition, it offers a worth-while production advantage; the total length of infeed cycle does not change, regardless of reduction in diameter of the grinding wheel. The diagrams on the opposite page show how this is accomplished; by automatically compensating for slide movement at the end of the cycle. As a result, for any given infeed setup, rate of production is uniform throughout the entire lot of parts. ¶ You can now have CINCINNATI Automatic Electric Gage Sizing on any new CINCINNATI FILMATIC Plain Hydraulic Grinder (6", 10"-L, 10", 14"-L). In conjunction with other outstanding Cincinnati advantages such as FILMATIC grinding wheel spindle bearings and automatic wheel balancing, Cincinnati offers top value for your precision grinding operations. Our field engineers and sales representatives want to tell you more about these Cincinnati features and how they will reduce costs in your shop.

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AUTOMATIC ELECTRIC GAGE SIZING EQUIPMENT ON CINCINNATI FILMATIC 10" PLAIN HYDRAULIC GRINDING MACHINE.

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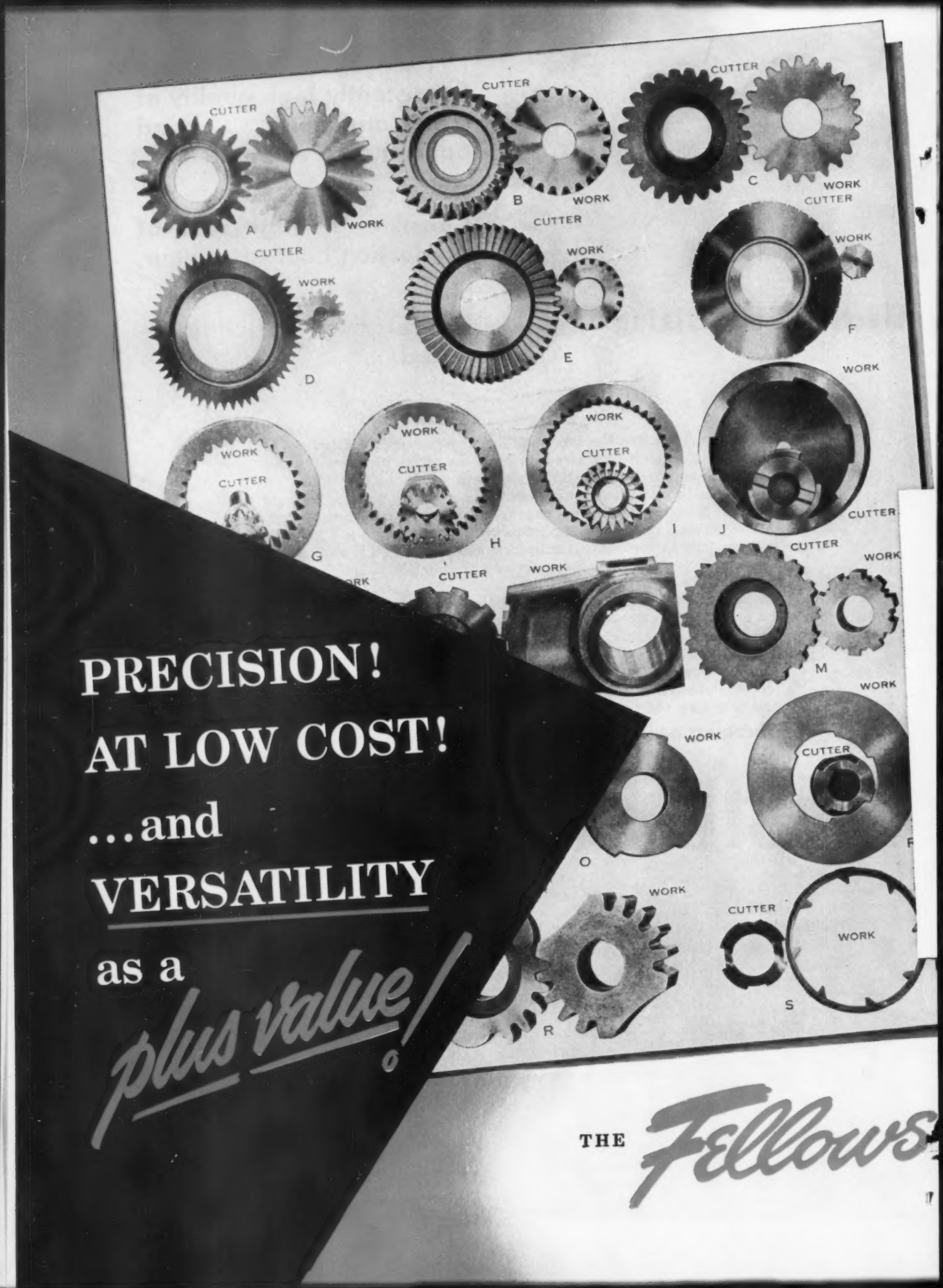
CINCINNATI FILMATIC 10"x18" Plain Hydraulic Grinding Machine equipped with Automatic Electric Gage Sizing. Complete information in two publications: G-603 and G-638.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PRECISION!
AT LOW COST!
...and
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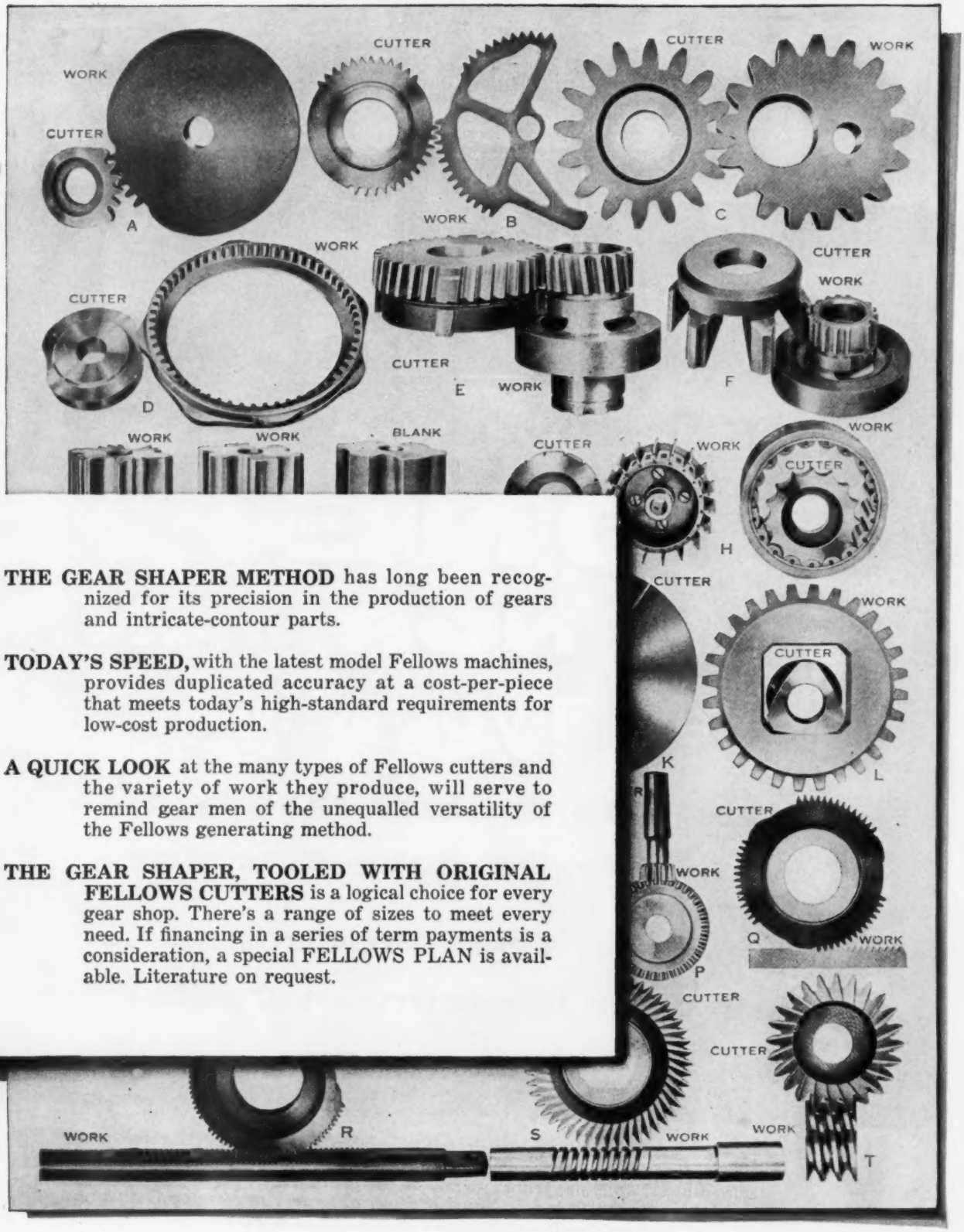

THE GEAR SHAPER METHOD has long been recognized for its precision in the production of gears and intricate-contour parts.

TODAY'S SPEED, with the latest model Fellows machines, provides duplicated accuracy at a cost-per-piece that meets today's high-standard requirements for low-cost production.

A QUICK LOOK at the many types of Fellows cutters and the variety of work they produce, will serve to remind gear men of the unequalled versatility of the Fellows generating method.

THE GEAR SHAPER, TOOLED WITH ORIGINAL FELLOWS CUTTERS is a logical choice for every gear shop. There's a range of sizes to meet every need. If financing in a series of term payments is a consideration, a special FELLOWS PLAN is available. Literature on request.

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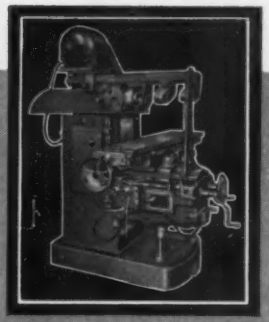

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Increases Your Production... Cuts Your Investment Costs!

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TABLE SIZE: 64″ x 14″
CUTTERHEAD MOTOR: 10 HP
RAM MOVEMENT: 29″

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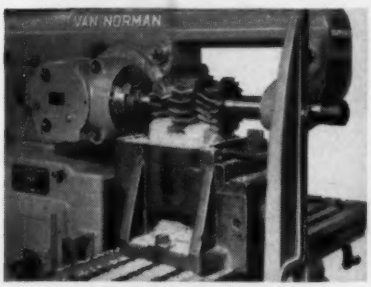
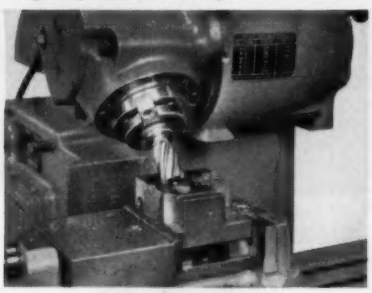
With the Van Norman Miller you do horizontal, vertical, as well as angular milling on one machine. The result — you keep the miller working at capacity every shift. You eliminate idle machine and worker time . . . increase production.

Ten new models with cutterhead motors ranging from 1½ HP to 10 HP and table sizes from 37½″ x 9⅜″ to 64″ x 14″ give you a wide range of selection. Write for complete information, today.

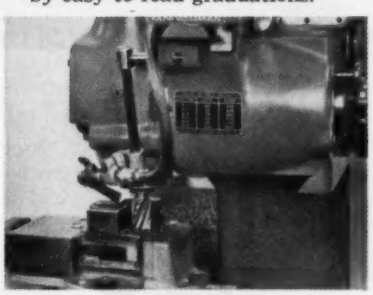
HERE'S HOW IT WORKS



HORIZONTAL
A heavy horizontal milling cut performed on the miller. Over-arm and outer brace provide maximum rigidity and accuracy.



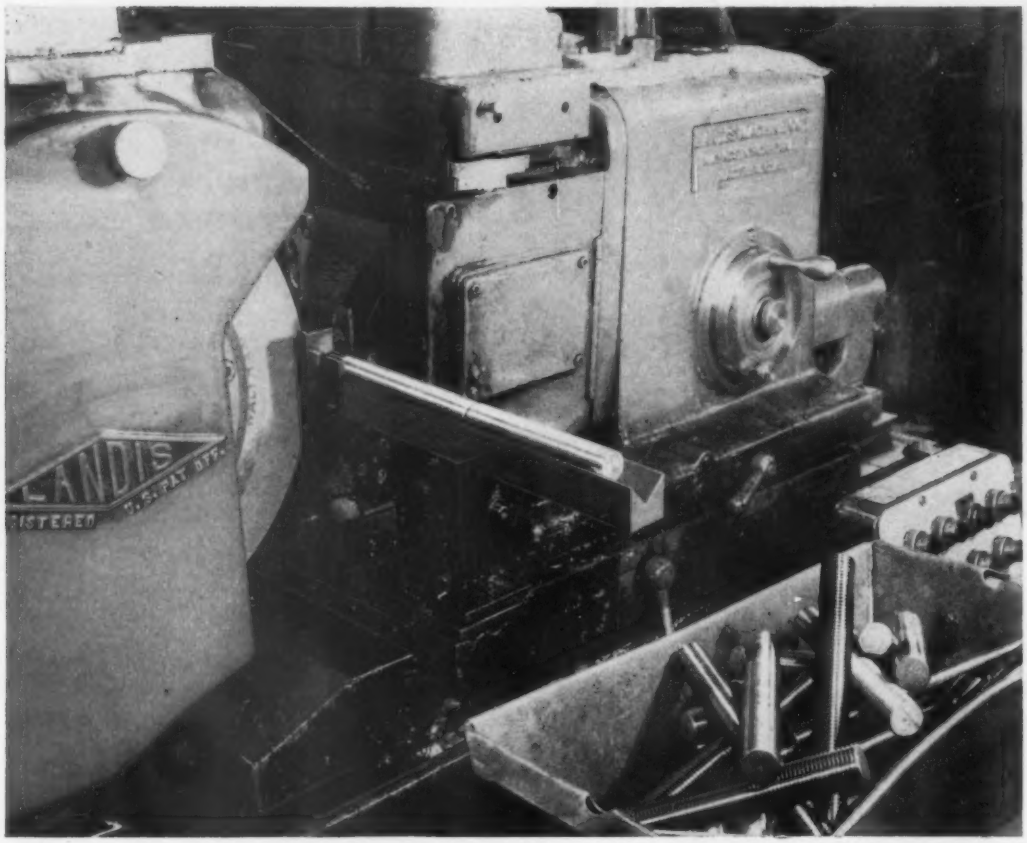
ANGULAR
An angular milling operation is being performed on a workpiece. Angular range of cutterhead is 0 degrees to 90 degrees. Accurate positioning is simplified by easy-to-read graduations.

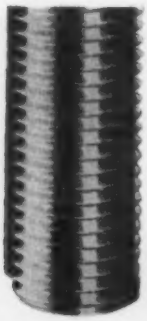


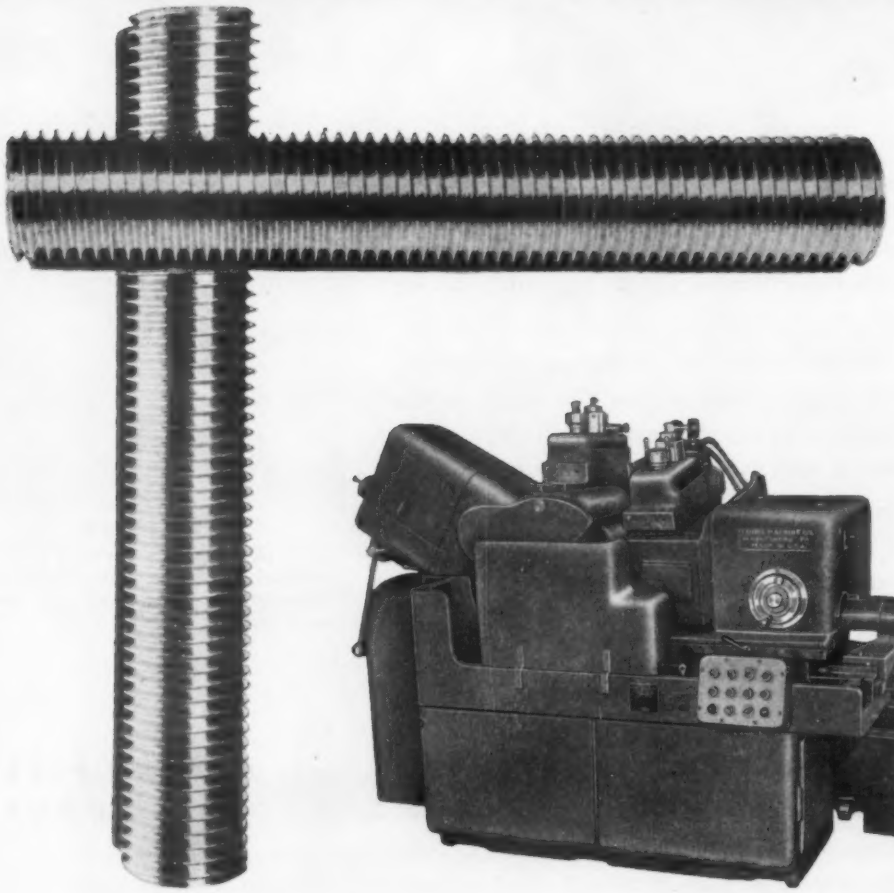
VERTICAL
With the cutterhead locked in the vertical position, a vertical milling operation is performed on the work piece.

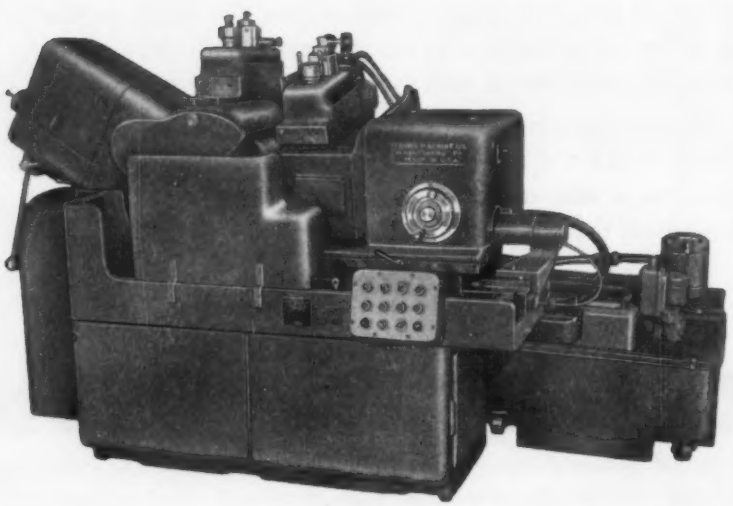
COMPANY

SPRINGFIELD 7, MASSACHUSETTS









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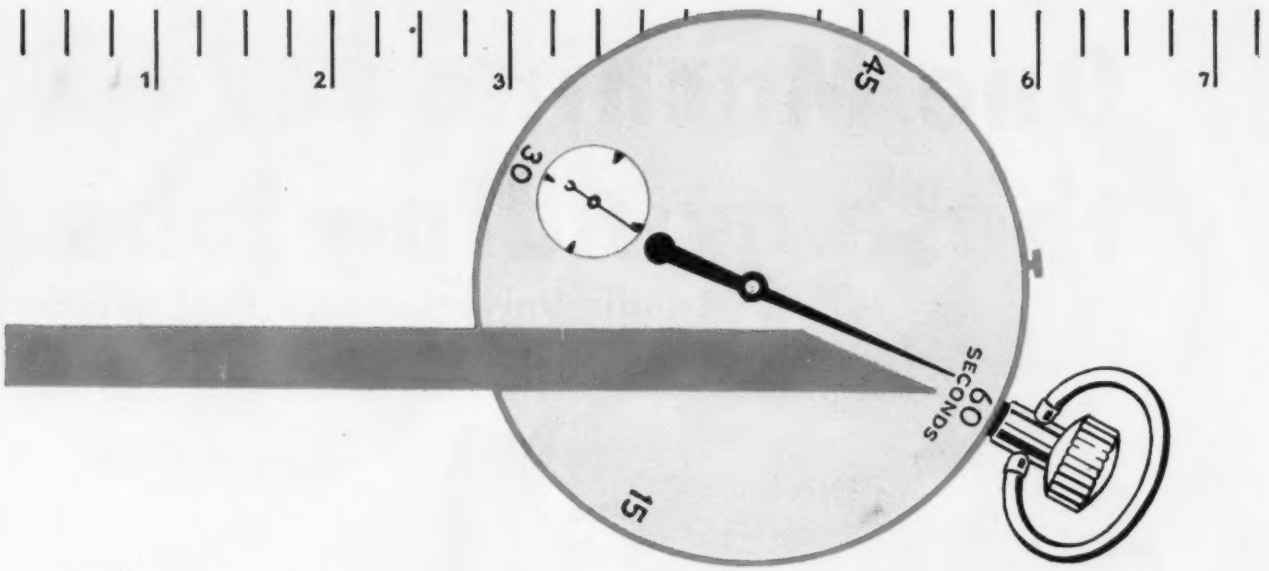

Threads 7¼" per Minute by CONTINUOUS GRINDING

LANDIS Centerless Thread Grinders are being used at the Kilbourn Engineering Company in Milwaukee, Wisconsin, to produce continuous threaded studs for high-pressure high-temperature service.

Studs ranging from ⅝" to 1⅜" in diameter are threaded from blanks of SAE 4140 steel heat-treated to a 260-320 Brinell hardness. In the operations illustrated, 1⅛" 8 pitch UN threads must be generated 10" long to a Class 7 fit to meet ASA standards (Manual B1.4). These threads are produced with LANDIS #1 Centerless Thread Grinders by continuous thru-feed grinding at the rate of 7¼ linear inches per minute, **or better.** The excellent quality and smooth finish of the ground thread has reduced final assembly time and minimized galling.

Centerless Thread Grinders, manufactured exclusively by LANDIS, are designed for the high-speed threading of a wide variety of workpieces from 1/16" to 4¾" in diameter. Blanks having one or more diameters, requiring threads on the outer diameter, can be threaded automatically by the thru-feed process used here.

Centerless Thread Grinding, by utilizing the "up-grinding" technique, is also well-adapted for threading workpieces of high hardness and coarse pitch. This process allows up to 30% higher work surface speeds, and often eliminates secondary threading passes required by other methods. For further information, send specifications and ask for Bulletin E-97.

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THE WORLD'S LARGEST MANUFACTURERS OF THREAD GENERATING EQUIPMENT

One Machine for all these grinding jobs

Landis Universal and Tool Grinder

Landis 12" x 28" Universal and Tool Grinder —two machines in one—a tool grinder and a universal grinder. Catalog K - 53

LANDIS
precision grinders

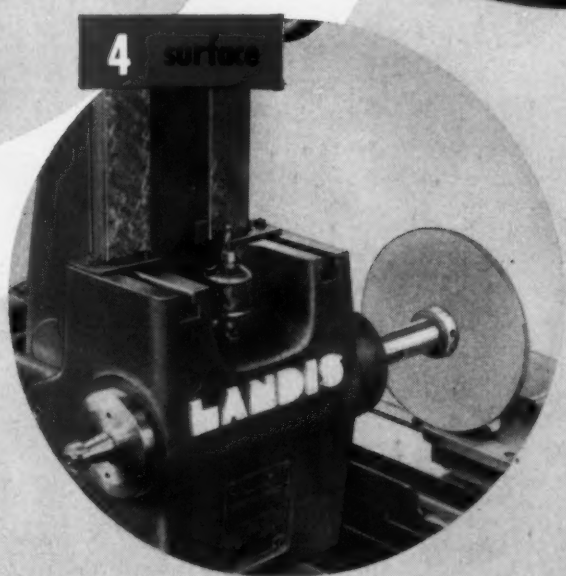
LANDIS TOOL COMPANY / WAYNESBORO, PENNA., U. S. A.

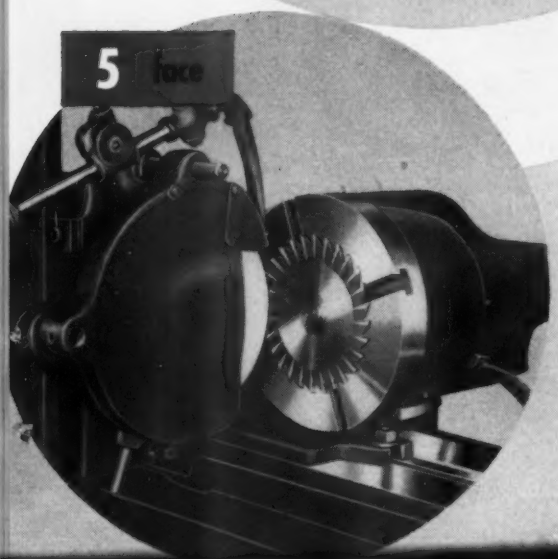
179

Also Performs These Grinding Operations:

6. Clearance on saws, cutters and reamers
7. Flutes on taps
8. Face of teeth on formed cutters
9. Spiral mill grinding
10. Milling cutters
11. Wet grinding
12. Dry grinding
13. Hobs
14. Parallel blocks, flat forming tools and dies
15. Screw machine and other forming tools
16. Angular wheel face
17. Reamers, taps and form cutters
18. Gear cutters
19. Face mills
20. End mills
21. Drills
22. Saws

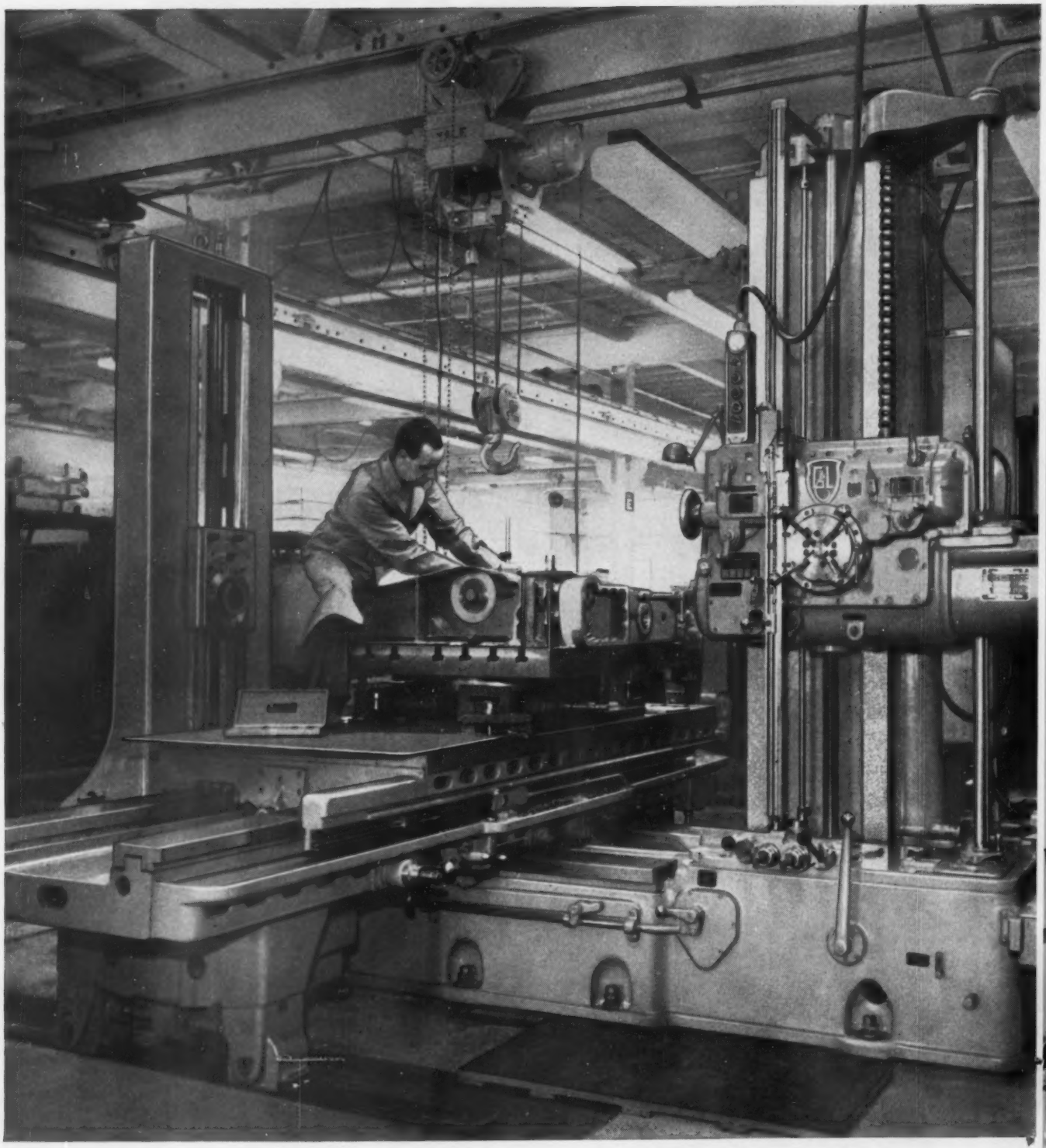
(All operations can be done with standard and extra equipment)



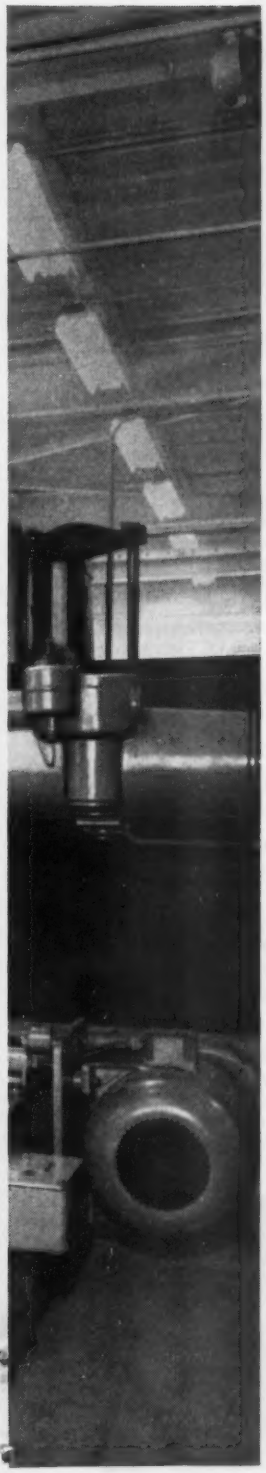


Stacy Machine Works Inc. reports:

"This machine is the



pride of our shop"



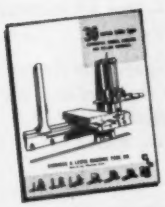
Here's production without rejects... precision boring within .0005"... and alignment and squareness to .001"... all accomplished on a G&L Model 340-T Table Type Horizontal Boring, Drilling and Milling machine with an Automatic Electric Positioning Device

Here's what a company executive of Stacy Machine Works, Inc., Agawam, Mass. said about their Giddings & Lewis Model 340-T Horizontal Boring, Drilling and Milling machine: "This machine is the pride of our shop. We're more than pleased with it. Its services are always in great demand."

"Because the Model 340-T is so versatile, our machinist can perform many complex, precision operations in a single setup . . . apply faster cutting speeds on heavy cuts and hold exact tolerances. One of the many workpieces we produce is this 40" x 50" cast aluminum Gimbal ring. Critical points in machining this casting are alignment of bores and squareness to .001" and bore diameters finished within .0005". What's more, the entire lot of 63 pieces were completed without a single rejection."

This Model 340-T is equipped with an extended saddle with saddle supports and an Automatic Electric Positioning Device. The accessory rotary indexing table is mounted on the machine table. With this combination the operator is able to materially reduce the time ordinarily required to set up and index the work. The Automatic Positioning Device automatically locates and controls the distances between machined holes.

If you, like Stacy Machine Works, Inc. face unusual machining and production problems, call in your G&L representative. He'll be glad to help you solve them.



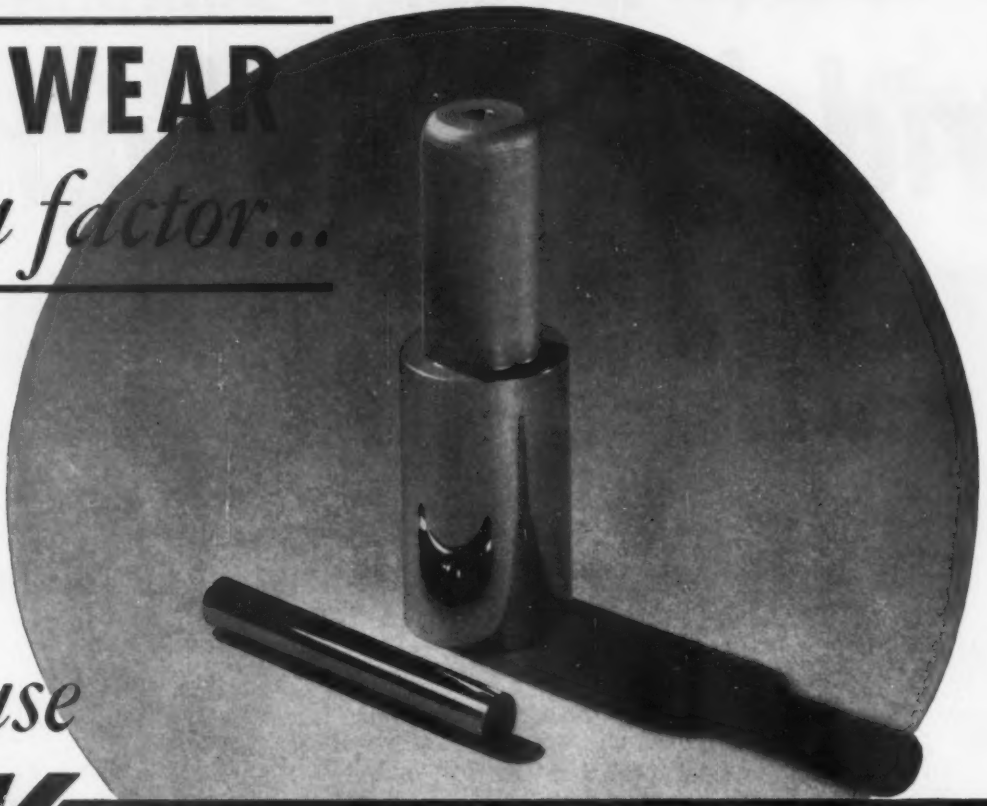
LITERATURE AVAILABLE:
Ask for Catalog No. 30-T with details on 30 Series Precision Horizontal Boring, Drilling and Milling Machines

GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Openside Planers, Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools

If WEAR *is a factor...*



...use VK CARBIDE PLUG GAGES

TUNGSTEN CARBIDE
wire type .016" to .500" diameter
CHROME CARBIDE
taper insert type .500" to 1.510" diameter

In addition to its regular line of tungsten carbide wire type plug gages from .016" to .500" diameter, The Van Keuren Company now offers a new line of chrome carbide taper insert plug gages in the range from .500" to 1.510" diameter.

Van Keuren tungsten carbide wire type gages have proved their worth on thousands of tough gaging jobs. The new chrome carbide taper inserts (Carboloy, grade ‡608*) promise to be equally effective. Wearing qualities of chrome carbide are comparable with tungsten carbide. In addition, the material is lighter than tungsten carbide and has a coefficient of expansion close to that of steel . . . both of which factors are a distinct advantage in the larger sizes.

*Trademark of the Carboloy Dept. of General Electric Company.

Finish on Van Keuren gages in either tungsten carbide or chrome carbide will average .5 RMS or better. These gages are available in Class Y, X, and XX accuracies at moderate prices and on a reasonable delivery basis.

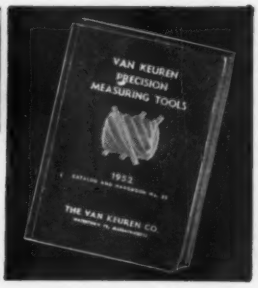
Send for a copy of the 220-page Van Keuren Catalog and Handbook No. 35 containing valuable technical and engineering information on measuring problems and methods. Address: The Van Keuren Co., 173 Waltham St., Watertown, Mass.

VK
36th YEAR

THE *Van Keuren* CO.,

173 WALTHAM STREET, WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires • Chrome Carbide Taper Insert Plug Gages.



No. 4 in a series

STEP UP WITH CONE

You send print to Cone

Cone makes recommendations

Cone submits samples of your work

You get demonstration of your work and complete job development record

No "automatic" user can afford to be out of touch with the latest developments in the use of carbide tools.

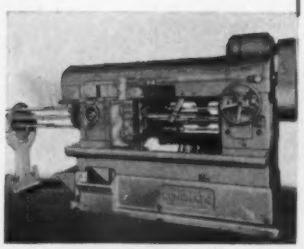
The popularity of the Conomatic Carbide Development program has made necessary larger quarters for increased clientele accommodation.

This innovational Cone service is without obligation of machine purchase and is available to users of any brand of multiple spindle automatic.

It costs nothing to know just how profitable your work might be with modern machines, tools, and know-how.

DATA FOR COMPARISON

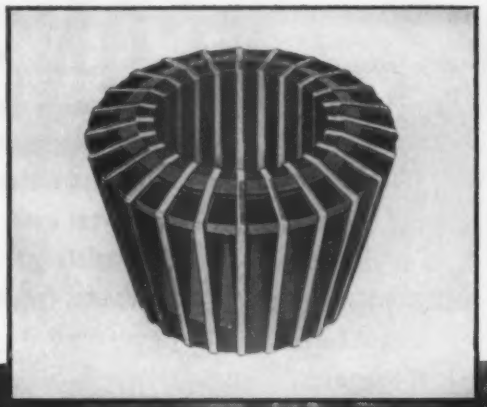
Part.....Spec. Cap Screw	Length.....4 17/32" Cutoff 2" Thread
Machine.....1⅝" Conomatic	
Tools.....100% Carbide Tipped	RPM.....885 Work Spdl. 580 Th'd Spdl. 1465 Total Eff'd.
Material.....8742	
Stock Size.....1" Across Flats	Time.....14 Secs.



Conomatic

Send for particulars on "Four Steps With Cone"

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U.S.A.



Once again!...

Jacobs doubles

production rate–

grinds 100% faster

Leading chuck manufacturer uses Norton machines to cut grinding time in half

When a leader like The Jacobs Manufacturing Company selects equipment, you can be sure that this equipment has had careful study from every angle of performance and cost.

That's why Jacobs' choice of Norton grinding machines is worth serious consideration when *you* are buying grinding machines.

In producing their famous Rubber-Flex Collets, for example, Jacobs reports that switching from separate operations to a single operation on Norton Type CTU Semiautomatics with multi-wheel mounts has doubled their production rate. *Jacobs reported similar production savings in grinding chuck bodies on the same type of Norton machines.*

Another manufacturer has boosted production from 300 to 600 parts per hour by grinding 2 diameters at once on a Norton machine. Still another reports that a Norton grinding machine with a triple-wheel mount has upped his production rate 128%. Throughout industry, manufacturers are using Norton grinders and lappers to save time, work and money in grinding operations.

Norton Machines in Your Own Grinding bring the same profit-increasing advantages. And remember: only Norton offers you such long experience in both grinding wheels and machines to help you produce more at lower cost.

For further facts, see your Norton Representative, or write us direct. NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

To Economize, Modernize With NEW

NORTON

GRINDERS and LAPPERS

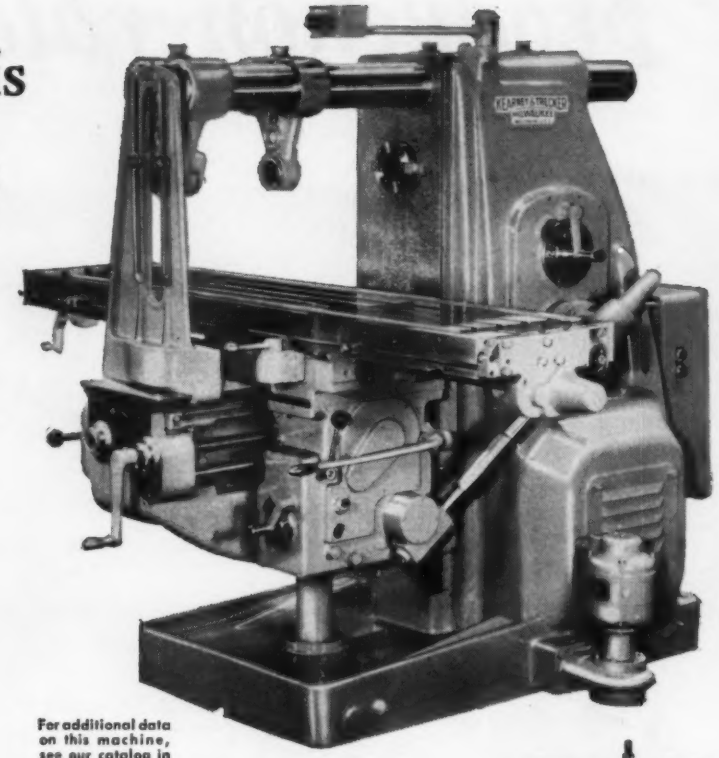
Making better products... to make other products better

District Sales Offices: **West Hartford • New York (Teterboro, N. J.) • Cleveland • Chicago • Detroit**

In the Jacobs Plant. One of the Norton 6" Type CTU Semiautomatic Grinding Machines used by The Jacobs Manufacturing Company of West Hartford, Connecticut, to grind metal inserts in the famous Rubber-Flex Collets. The basically fast action of this Norton grinder, the multi-wheel mount, special swivel table arrangement and wheel-truing device provide a single setup for traverse and shoulder grinding operations that boosts production rate 100%.

PAY-OFF PRICE ONLY

when you put this new 7½ hp No. 3 Model CE plain milling machine to work in your plant with...



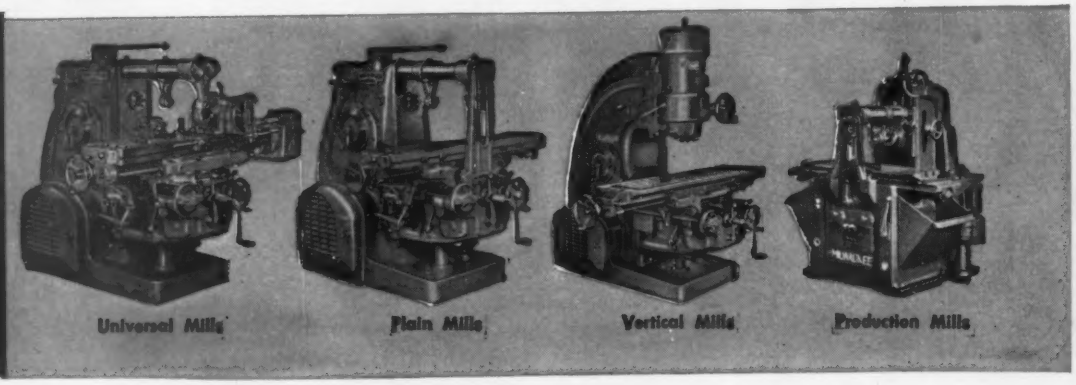
For additional data on this machine, see our catalog in Sweet's.

Kearney & Trecker's

TOOL-LEASE

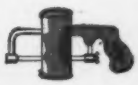
PROGRAM

Kearney & Trecker manufactures a complete line of more than 250 standard knee and bed type milling machines and precision boring machines.

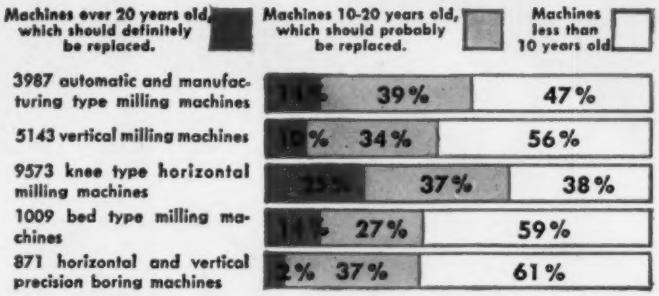


27 CENTS PER HOUR...

LET'S LOOK AT THE OBSOLESCENCE PICTURE IN THE FABRICATED METAL PRODUCTS INDUSTRY

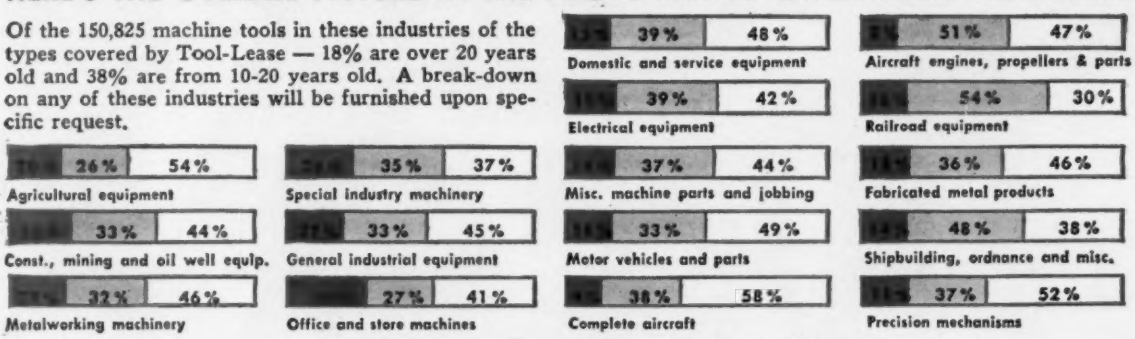


Includes machines for hand tools; hardware; oil burners; structural steel; boilers, sheet-metal, enameled, stamped and pressed metal products; powder metallurgy, wirework; screw-machine products; metal specialties, games, toys, jewelry and sporting goods. Of the total 20,583 machines, 18% are over 20 years old and over 36% are 10 to 20 years old!



HERE'S THE OVERALL PICTURE IN THE ABOVE AND 15 OTHER BASIC INDUSTRIES

Of the 150,825 machine tools in these industries of the types covered by Tool-Lease — 18% are over 20 years old and 38% are from 10-20 years old. A break-down on any of these industries will be furnished upon specific request.



Figures adapted from 1953 American Machinist survey of metalworking industry

IT'S true! Under Tool-Lease you can lease this new 7½ hp No. 3 Model CE plain milling machine for *only 27 cents per hour.* This Model CE is Kearney & Trecker's answer to industry's need for a milling machine that combines *quality and low initial cost* with efficiency, ease and economy of operation.

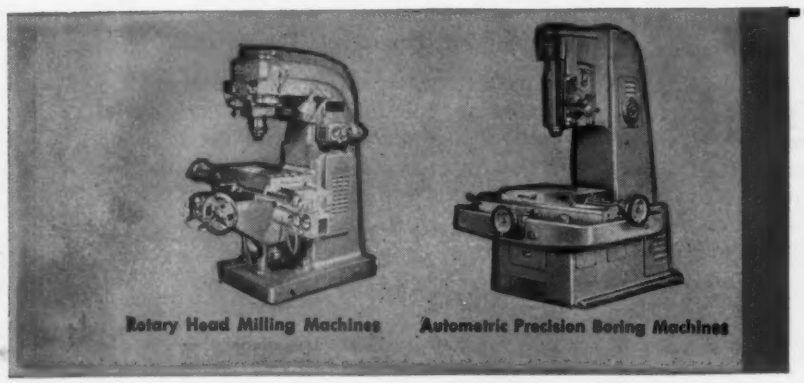
Under Plan "A," one of three possible lease agreements, you make two semi-annual payments, totaling 25% of the machine's price during each of the first three years. And only 10% during each of the last four years.

What's more, under Tool-Lease you can rent any of over 250 different types and sizes of standard milling machines or precision boring machines. All are available under three basic plans, with varying options to continue or terminate the lease, or to purchase the equipment. If you require special machinery or heavy-duty CSM bed types, special agreements will be considered.

For complete information on Tool-Lease, see your Kearney & Trecker representative or mail coupon to Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.

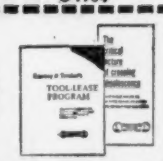
TOOL LEASE
KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS
EQUIPMENT ®

©1954



KEARNEY & TRECKER CORP.
6784 W. National Ave., Milwaukee 14, Wis.

Please send me Bulletin TL-10A on Tool-Lease Program and booklet titled "Critical Picture of Creeping Obsolescence."



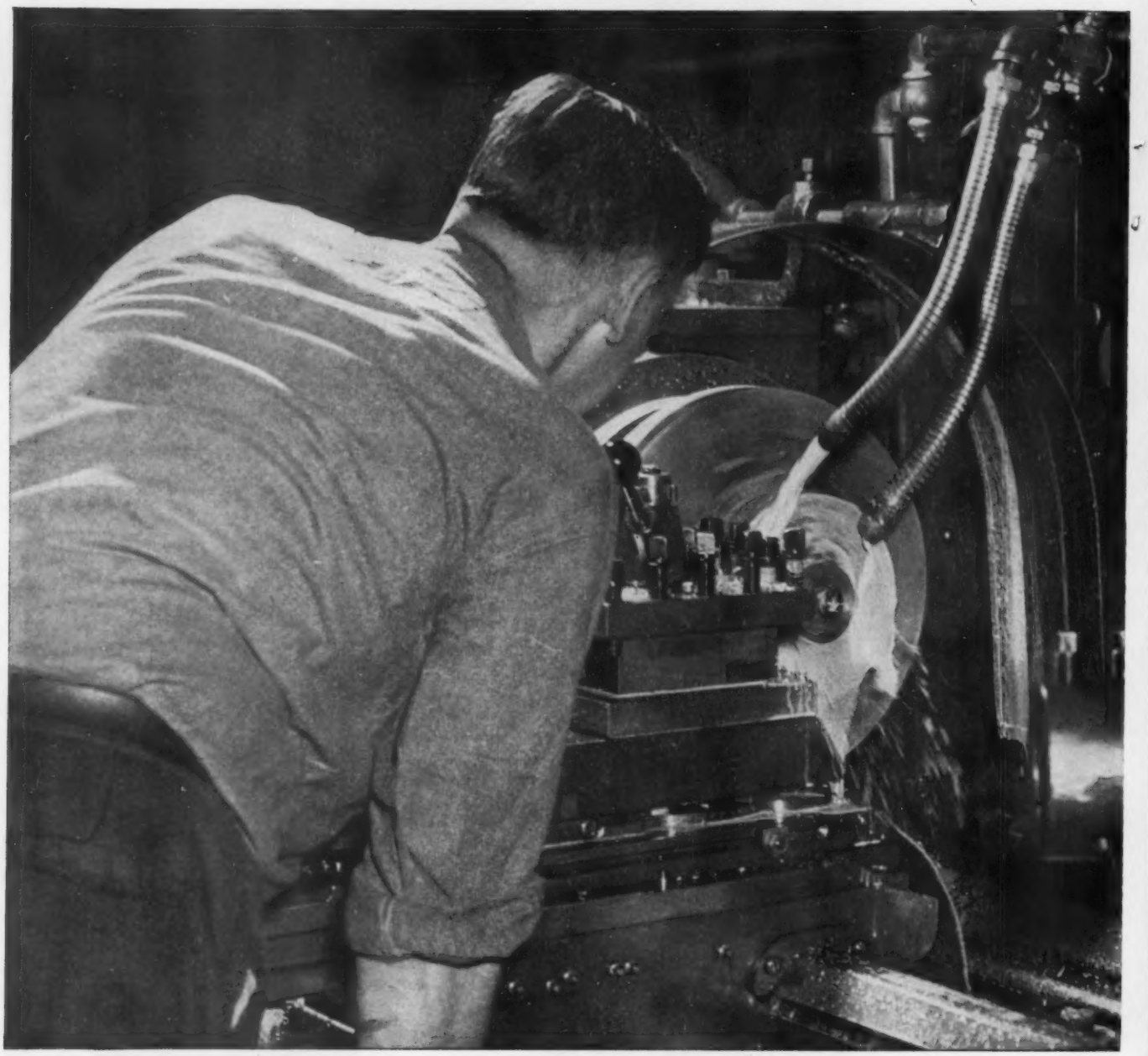
Name.....

Title.....

Company.....

Address.....

City.....Zone.....State.....



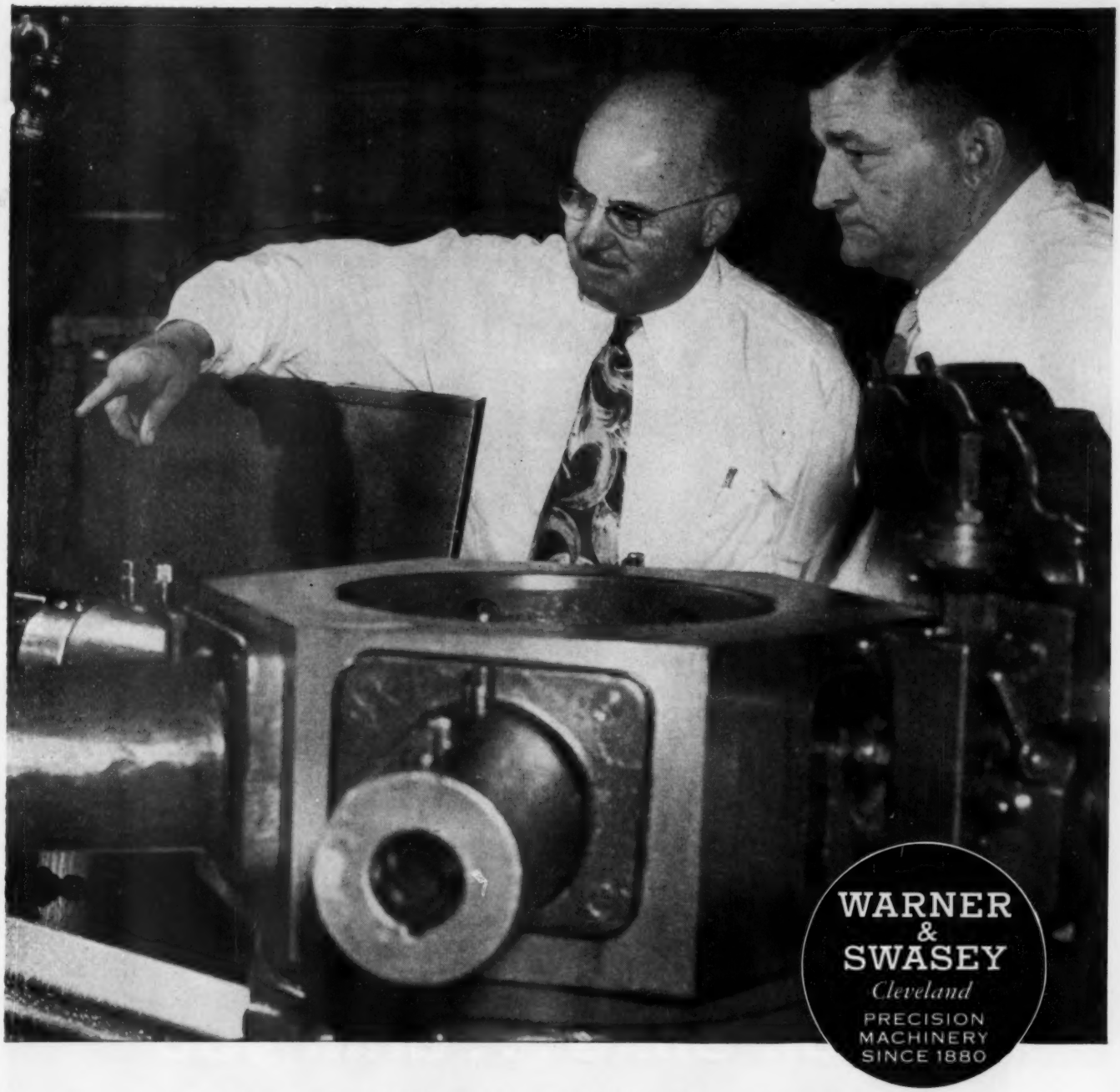
Built right– Sold right

• Warner & Swasey Machine Tools have established enviable records for high productivity, low maintenance and minimum downtime. They've *proved* their dependability – holding their accuracy for years after they have paid for themselves. They're *built right!*

Warner & Swasey's principle of design plays an important role in this success. Each model is *individually designed* – from the floor up – to handle a *specific range of work.* Machine handling time is thus minimized.

Skilled craftsmen, working to exacting

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER &



Warner & Swasey standards, combine the most modern machines and processes with certain time-honored hand techniques . . . so necessary to insure the traditional Warner & Swasey accuracy.

And Warner & Swaseys are *sold right!* By turning specialists who follow a rigid Warner & Swasey policy—that they recommend and sell a machine *only* when it completely fulfills the requirements of your particular work.

These turning specialists are also at your service long *after* the order is written. Your nearest resident Field Representative, one of 47 located throughout the country, is quickly available to you. He's ready to lend his training and experience to help you *maintain* the high productivity of the Warner & Swaseys in your plant.

So whatever your turning needs—whether it's a machine for a specific job, or if you're looking for greater production through modernization . . . call in your nearest Warner & Swasey Field Representative.

SWASEY MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

"Sure, all Drills
look alike . . . until you
LOOK AT
THE SCORE!"

In looks and construction, most drills are alike as peas in a pod. *But the all-important difference is in the accuracy and quantity of the holes they cut.* So when you come right down to it, the price of the drill itself means little. It's the *cost-per-hole-produced* that really counts.

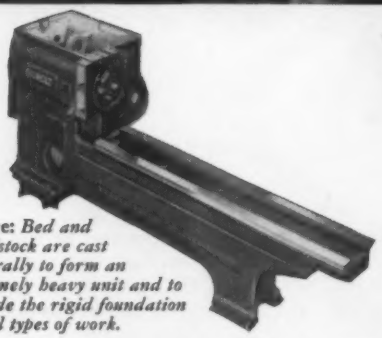
Look at it this way: An increase of 10% in production . . . plus an automatic reduction in set-up and down-time . . . can make the difference between profit and loss on any production job. On top of that, the assurance that every hole is accurate and uniform means that spoilage and reworking are practically eliminated. And remember that the cost of down-time on most production lines today is a *mighty multiple* of the cost of the tool that has to be replaced. Remember, too, that it takes only one sub-standard drill in a gross to wipe out any saving that may have been made on the tool-purchase.

Now . . . if you want the real score on drill performance (and on the complete line of Morse Cutting Tools) just ask your Morse-Franchised Distributor. He's the man you can always bank on for the tops in quality and the best in service.

MORSE TWIST DRILL & MACHINE COMPANY
NEW BEDFORD, MASSACHUSETTS
(Division of VAN NORMAN CO.)
Warehouses in New York, Chicago, Detroit, Dallas, San Francisco

MORSE
Cutting Tools

. . . buy them by phone from your Morse-Franchised Distributor and save ordering time



Above: *Bed and Headstock are cast integrally to form an extremely heavy unit and to provide the rigid foundation for all types of work.*

Below: *Block type ways are straddle keyed to the bed and ground in perfect alignment with the spindle. All working surfaces are hardened to 64-66 Rockwell "C".*

ACCURACY THAT DOESN'T "WEAR OFF"

Here are two good reasons why you can count on the accuracy of Gisholt Turret Lathes—now and years from now.

One-piece bed and headstock, cast as a heavy, rigid unit, reduce distortion and vibration to a minimum. Headstock is jig-bored to insure—and maintain—perfect alignment of spindle and drive shafts, with ample metal to provide the most solid support possible.

Hardened steel ways are augmented by hardened steel strips secured to the ram saddle, as well as hardened steel gibs and clamps, making an assembly that is virtually wear-proof. Its accuracy is further preserved by force lubrication.

These advantages are yours for the long life of any Gisholt Turret Lathe. Ask for complete details.

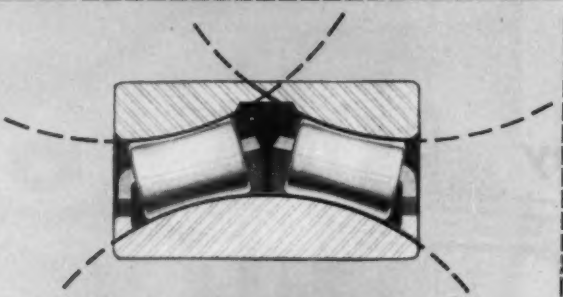
THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.*

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

These important
bearing differences
may spell longer machine life for you



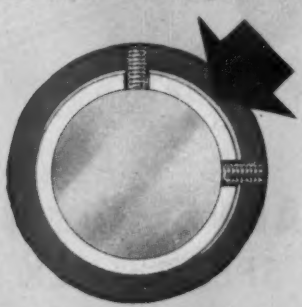
FREE ROLLING—SELF-ALIGNING. Inner ring is truly spherical, free to align in any direction without altering contact area with rollers. Full load capacity is always assured despite shaft deflection or misalignment.

Buna N and Felt Seal for extremely dirty conditions.

Labyrinth Seal for normal conditions.

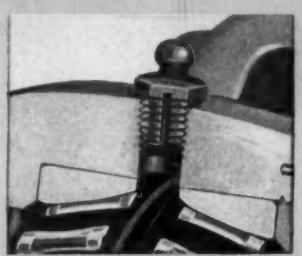
EFFECTIVE SEALING. Buna N and Felt or Labyrinth Seals (see above cut-aways) keep grease in and dirt out.

COLLAR SECURELY LOCKS INNER RING TO SHAFT. Tendency for collar to assume original circular shape reacts against threads of set-screws to maintain tightness. Use of set-screws in collar avoids distortion and possible breakage of inner ring.



Spring locking collar with two knurled cup-point set-screws hold bearing firmly in position.

EXCESSIVE GREASE PRESSURE PREVENTED. Lubrication fitting with pressure relief feature permits escape of excessive grease. Bearings are prelubricated and sealed at factory, ready for operation.



They're all present only in LINK-BELT roller bearings

BEARING inefficiency costs you more than replacement alone. The life of your machines is affected . . . capacity decreased . . . power wasted. That's why Link-Belt features unrestricted alignment of both ball and roller bearings. It compensates for shaft deflection or support distortion.

Every Link-Belt bearing offers advantageous *differences*—some big, some small, all important. Ask your Link-Belt office or authorized stock carrying distributor for Data Book 2550 covering this complete line of pillow blocks plus flange, flange-cartridge, cartridge, take-up and hanger blocks and self-aligning bearings.

Series 400 roller bearings are part of industry's most complete line of ball and roller bearing blocks.

13,712-A

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

LINK-BELT

Ball and Roller Bearings

For...

General-Purpose Sawing

with

High Speed

Accuracy, Economy

Model 4B/M2/E2
Equipped with standard
work track
(Optional Equipment).

MARVEL No. 4B
HIGH SPEED HACK SAW

Exclusive features

1. **Horizontal Ball Bearing Saw Frame.**
2. **Screw Feed—Automatic or Hand Operated.**
3. **Quick Return Stroke—allows greater number of strokes per minute.**
4. **Simple Positive Coolant System.**
5. **Adjustable Stroke—can be shortened for larger capacity.**
6. **Speed Range—available in 1, 2 or 4 speed models for wider range of work.**

Let us prove to you the many reasons why this MARVEL Hack Saw offers the cheapest, most accurate and fastest "cut-off" method available to you at a low initial cost.

Ask your dealer, or write us for Bulletin GP35 which fully describes and illustrates the many exclusive features which makes this Hack Saw Machine your "best buy".

Metal Cutting
MARVEL SAWS
Better Machines–Better Blades

ARMSTRONG-BLUM MFG. CO. • 5700 Bloomingdale Avenue • CHICAGO 39, ILL.

Change in Grain Size and Structure Cuts Abrasive Costs 80%

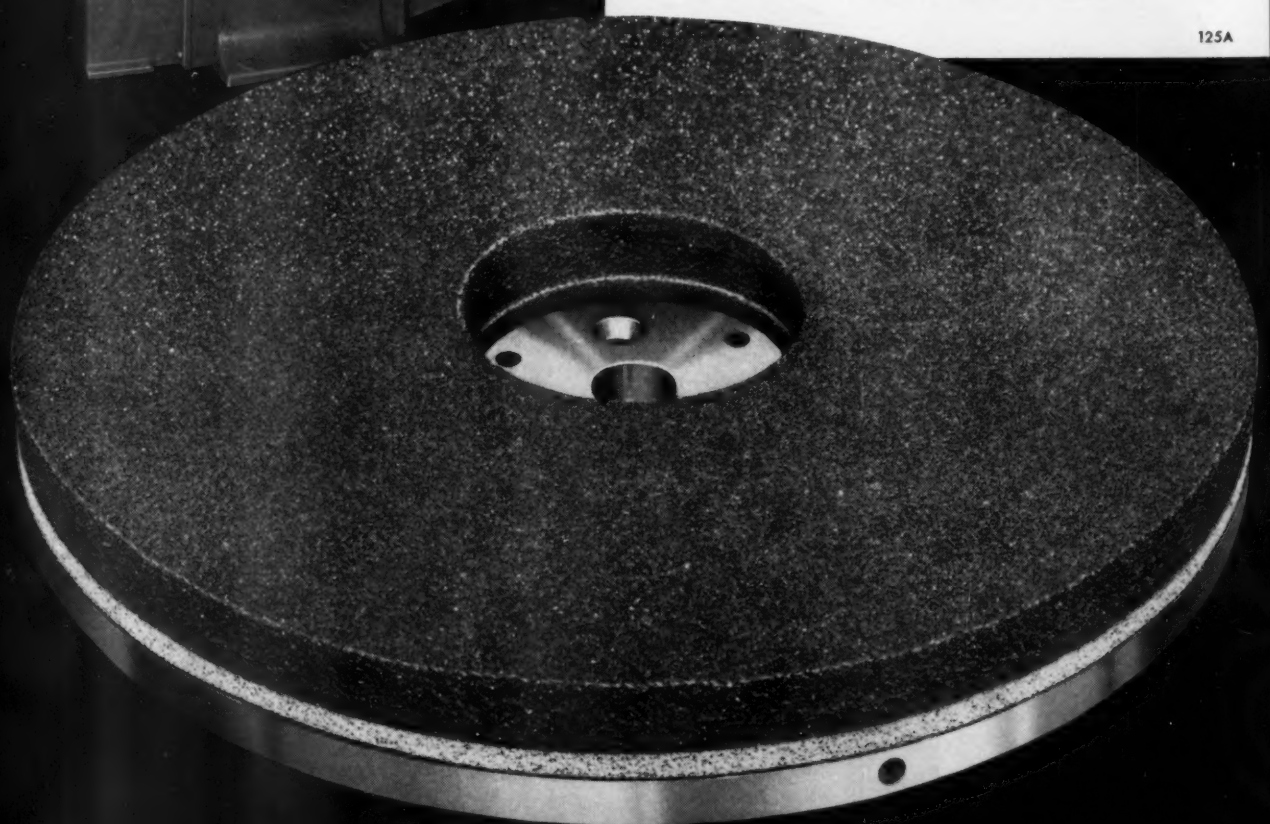
Grizzly Manufacturing Division grinds 5½ times more brake lining per disc

An 80% cut in abrasive disc costs in grinding brake lining is reported from Grizzly Manufacturing Division of Paulding, Ohio.

Looking for ways to cut costs, their production men called in the Gardner Abrasive Specialist. Could Gardner make discs that wouldn't wear out so quickly?

The new Gardner disc stepped up production from 454,790 to 2,512,200 feet of lining per disc. That's 5½ times more production for each disc! Downtime for disc replacement has been turned into productive time.

125A



GARDNER

abrasive discs

BELOIT, WISCONSIN, U.S.A.

Carbide grinding's

Norton Vitrified Bonded Diamond Wheels feature fast stock removal and high resistance to grooving. Long service life is another big advantage, since this Norton-developed bond holds each diamond tightly, for maximum useful cutting action. *Typical Applications:* production grinding of single-point carbide tools; grinding chip breakers; cylindrical, surface and internal precision grinding of carbide tools, cutters, discs, gages, rolls, etc.

Norton Resinoid Bonded Diamond Wheels are made in two bond types — regular, for wet grinding and B6, for dry grinding. Each type gives you extra fast cutting action and long, money-saving wheel life. *Typical Applications:* grinding multi-tooth cutters, where their size-holding ability assures uniform height to each cutter tooth; cutting-off damaged carbide tools for salvage; grinding threads "from the solid" in carbide taps and thread gages.

"CROWN JEWELS"

Norton diamond wheels bring unbeatable economy to your production

You buy diamond wheels for carbide grinding as an investment in faster, better grinding performance and lower production costs.

You can be sure of peak profits from this investment when your choice is Norton diamond wheels. Backed by Norton's long leadership in development and manufacture — and by news-making "firsts" in diamond wheel progress — they're carbide grinding's recognized "Crown Jewels", with a royal reputation for the best in diamond wheel value!

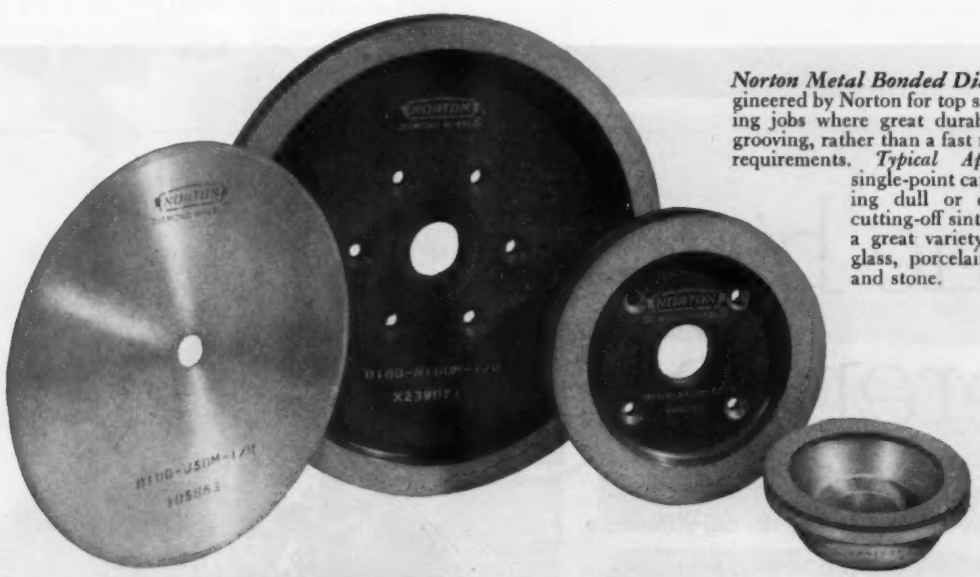
"CROWN JEWEL" Highlights

NORTON: was first to introduce resinoid, metal and vitrified bonded diamond wheels . . . does all its own sizing, grading and laboratory checking of diamonds . . . duplicates wheel specifications with constantly controlled accuracy, to assure you uniform top performance . . . brings you a complete line, covering every diamond wheel application in every field — carbide, stone, glass, ceramics, etc. . . . gives you fast service from full stocks in Worcester, five warehouses and Distributor's stocks.

Your Norton Distributor

is ready with quick deliveries of the diamond wheels you need for better, more economical carbide grinding. Ask him for the 142-page illustrated booklet, *Grinding Carbide Tools,* and the complete net priced Diamond Wheel Catalog or write for them direct. And remember: only Norton offers you such long experience in both grinding wheels and machines to help you produce more at lower cost. NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your phone directory, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

Making better products . . . to make your products better



Norton Metal Bonded Diamond Wheels are engineered by Norton for top savings on certain grinding jobs where great durability and resistance to grooving, rather than a fast rate of cut, are the chief requirements. *Typical Applications:* sharpening single-point carbide tools; reconditioning dull or chipped carbide tools; cutting-off sintered carbide blanks and a great variety of other materials — glass, porcelain, germanium, cermets and stone.

W-1614

NORTON

and its BEHR-MANNING division

NORTON: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING: Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

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"How can I get my shipments faster?"

He took her advice, what it was you can guess
Now orders come swiftly by ***RAILWAY EXPRESS***

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Railway Express makes the big difference in speed, economy, and safe, sure delivery. Whether you're sending or receiving, whether your shipment is big or small, and whether it's moving by rail or air, it will pay you to specify shipment by Railway Express. It's the complete shipping service in the American tradition of private enterprise.

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3 Reasons Why

Taft-Peirce Superpower Magnetic Chucks Save You Money

1 — You get the "right" chuck for every job. T-P offers you a complete line of *both* Electromagnetic and Permanent Magnet Chucks. A P-M Chuck has no wires to fail . . . no current to heat . . . it's the safest, most economical choice for many jobs. Ideal for grinding, light milling, planing, shaping, and bench work. Since we also make electromagnetic chucks, we'll be glad to advise you which is best for your job.

2 — T-P Cost-Cutting Designs. T-P offers you a selection of work-saving models — in practically all standard sizes and shapes. Maybe you need a T-P Superpower Chuck that tilts or swivels to save setup time. Or a fine mesh chuck to hold small or thin sections. Or a longitudinal pole chuck for greater versatility. Taft-Peirce makes them all and many more. Plus practically any special design you may need.

3 — Maximum Power and Performance. Taft-Peirce Superpower Magnetic Chucks combine maximum holding power with maximum working surface. Magnetic losses are low. Safety factors generous. Rugged, rigid, one-piece all-steel body is waterproof and shockproof. Little or no maintenance is ever required.

For information on Superpower Chucks and other items send for your copy of the Taft-Peirce Handbook.

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

NOW IS THE TIME . . .

TO REDUCE YOUR MANUFACTURING COSTS WITH A

CUTMASTER VERTICAL TURRET LATHE Model 75

This revolutionary new design of vertical turret lathe has exclusive features never before offered on machines of this type . . . takes full advantage of the latest improvements in cutting tools and methods . . . truly the machine with a "built-in" future.

PENDANT CONTROL . . .
provides maximum machine control from a movable pendant station. Start and stop spindle; selection of speeds, feeds and directional movement of all heads in feed or traverse are quickly and easily accomplished from the Pendant. Interlocks and a stopall stick provide safety for both operator and machine.

SCREW FEED . . .
is provided for vertical and horizontal motion of all heads to assure fine, smooth finishes with greater accuracy.

POWER INDEXED MAIN TURRET . . .
(Optional) Five sided turret for "run of the mill" jobs. Four sided turret for production jobs.

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THE BULLARD COMPANY
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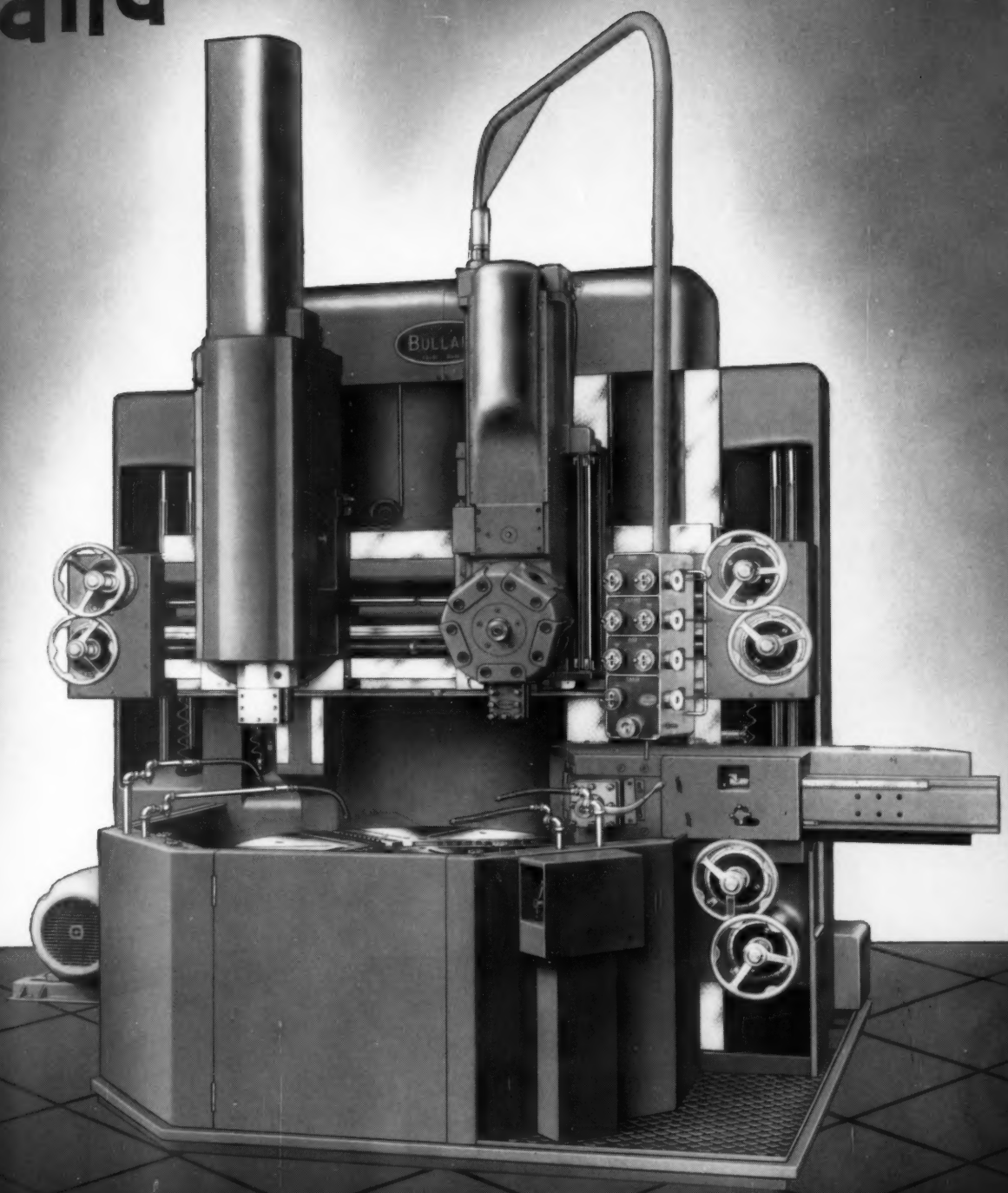
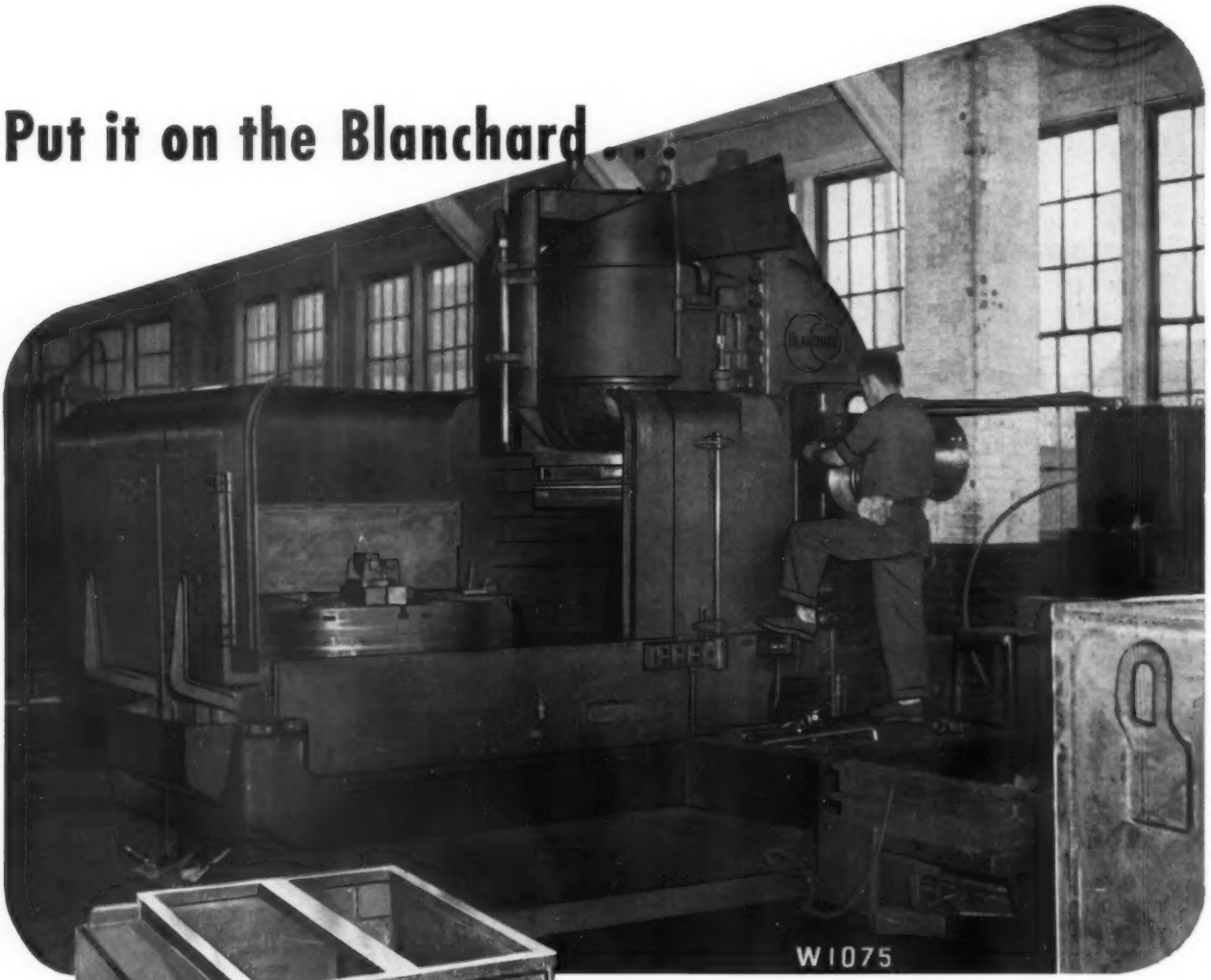
. . . and here is the way!



AVAILABLE IN 26, 36, 46, 56, 66 AND 76 INCH SIZES

Put it on the Blanchard . . .



it takes 1/5th the time!

Here is another example of the special jobs Blanchard Surface Grinders perform *in less time*, to exacting specifications.

These explosion-proof control cases are used in the coal mining industry. Each steel weldment case is 36" x 48" x 24" deep. Because gaskets cannot be used, surface finish, and flatness must provide a dust and gas explosion-proof metal seal.

A Blanchard Surface Grinder, the No. 32-60, removes approximately 1/8" of stock – in *one-fifth* the machining time formerly required.

Send a sampling of your parts for free test grinding and our recommendations.

Send for your free copies of "Work Done on the Blanchard", fourth edition, and "Art of Blanchard Surface Grinding".

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fast, economical production calls for

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hydraulic openside shapers

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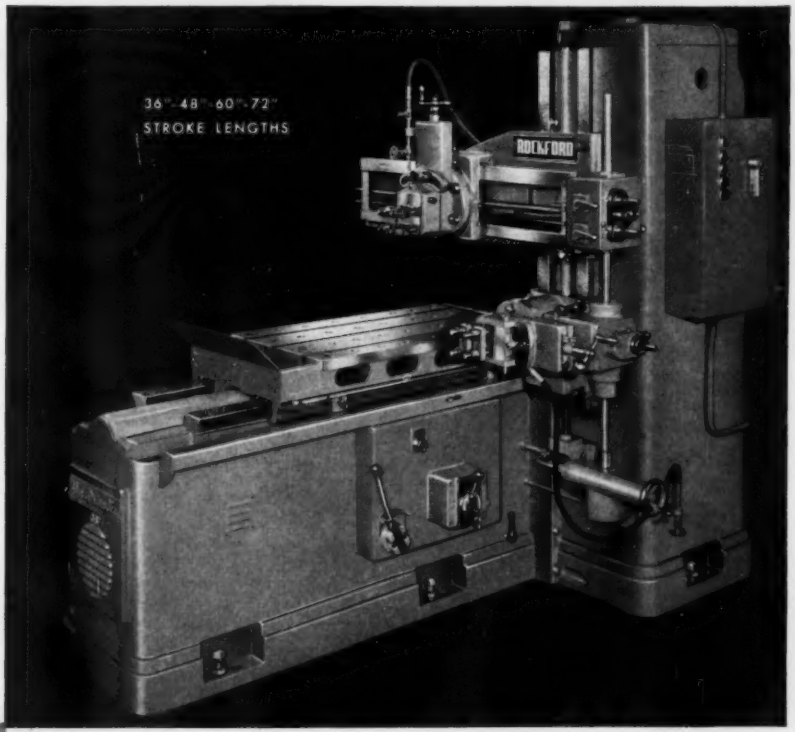

Hy-Draulic

Hydraulic Drive is a natural for reciprocating-type machine tools. It provides smooth, powerful cutting, fewer moving parts, and longer useful life.

Hydraulic Openside Shapers reciprocate the work instead of the tool and produce planer accuracy with shaper speed. When you modernize your production facilities plan on Hydraulic Shapers, Planers and Slotters to provide the fastest, most economical production methods.

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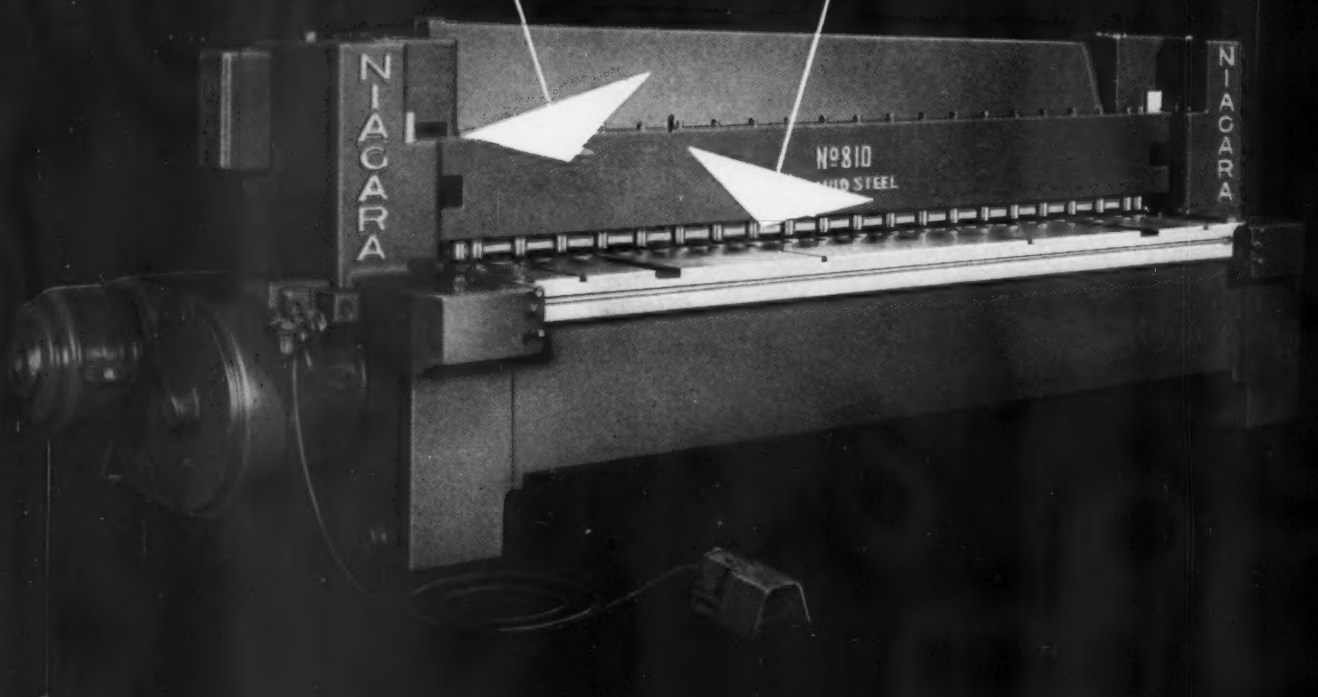

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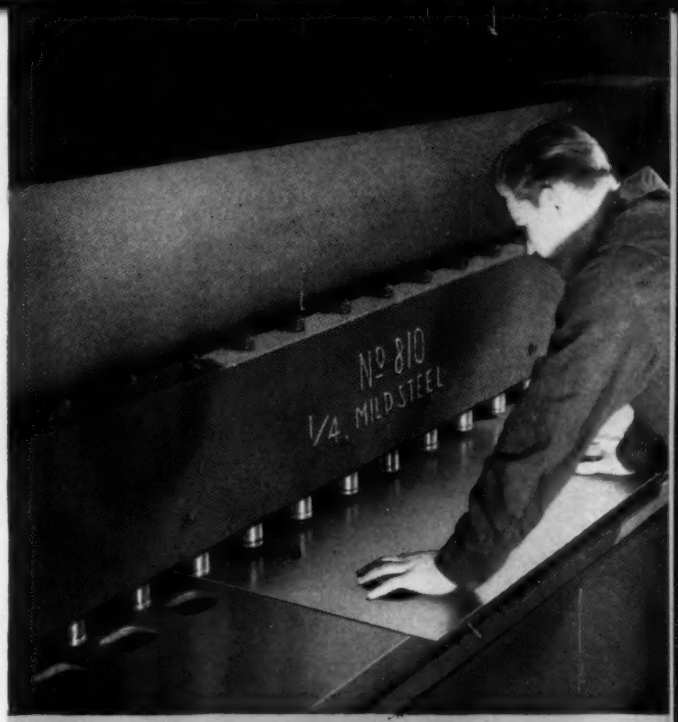

"STRAIGHT-EDGE" CUTTING ACCURACY
Positive, power actuation grips work securely for maximum cutting accuracy.

LOW IMPACT AVERTS DAMAGE AND INACCURACY
Individual pressure feet contact work with low impact, thus safeguarding both the material and bed against damage, as well as reducing noise level. No hammer-blows to mar work. No peening of bed with resulting distortion of knife seat.

SIMPLIFIED, LOW UPKEEP DESIGN
Simplicity of design and construction, involving a minimum number of parts, assures negligible servicing. With *less* to go wrong, there is *less* to repair and replace.

HOLDS WORK FLAT AND STATIONARY
Multiple pressure feet on 6" centers, applying uniform pressure, hold work flat and tight against bed to assure utmost shearing accuracy. No rippling of sheet between feet as cut progresses. Firm grip on short pieces.

HANDLES STOCK OF VARYING THICKNESS
Individual feet are self-compensating, requiring no adjustment for cutting stock of different thicknesses . . . *even at the same time.*

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For the whole story, straightforwardly presented, on America's most complete line of underdrive power squaring shears, with capacities from shim stock to 1 in. thick mild steel (lengths 3 to 20 ft.), request *Niagara Bulletin 69*. Write today.

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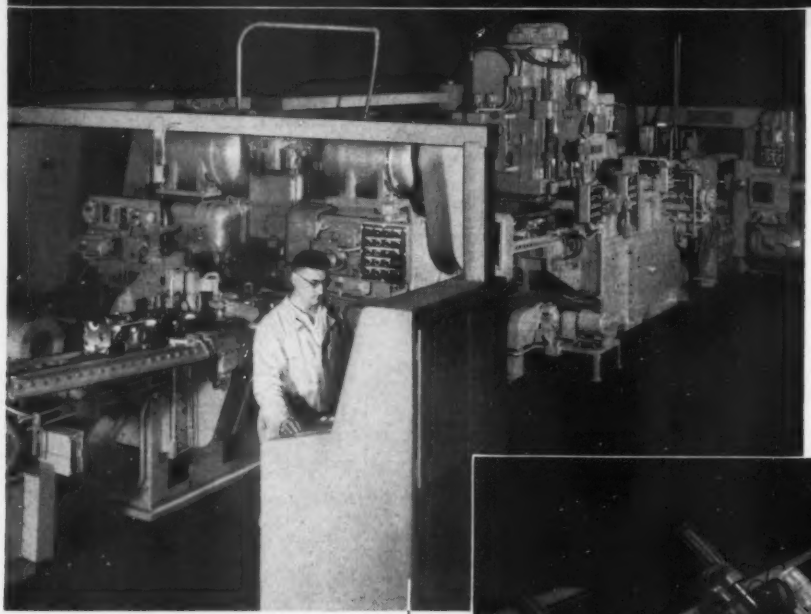
when you need PRODUCTION

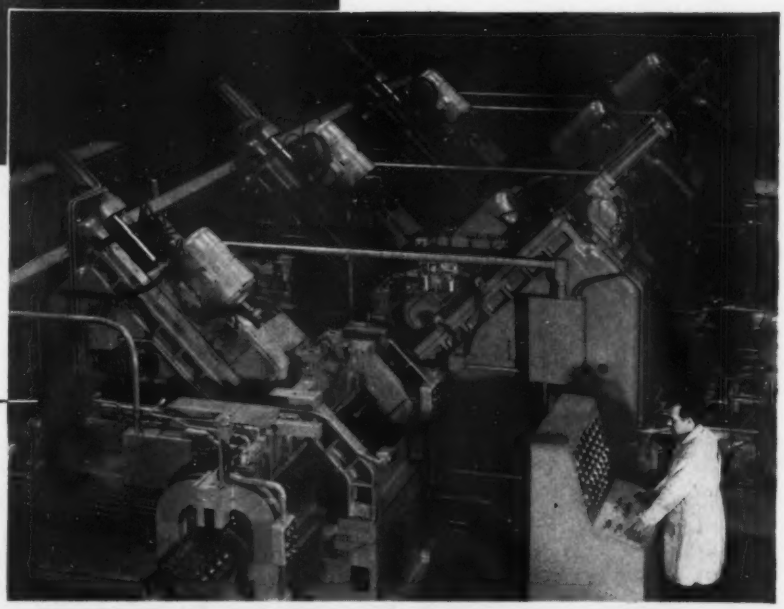
USE SUNDSTRAND "ENGINEERED PRODUCTION" SERVICE WITH TRANSFER TYPE MACHINES...



Four station line for machining 4 cylinder engine blocks. Nine operations are performed including milling, broaching, drilling and reaming.

FOR EXAMPLE:

These highly productive transfer type machines are the result of Sundstrand "Engineered Production" Service. In each case, the manufacturer and Sundstrand Engineers worked close together in finding the best processing method for the job at hand.



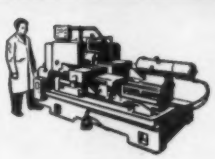
Rough boring unit of line for 8 cylinder V-type engine blocks has 16 spindles.

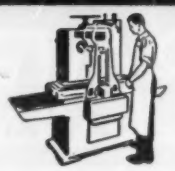
SUNDSTRAND

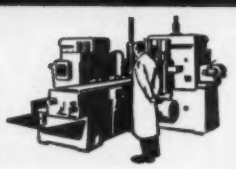
50 YEARS OF *"Engineered Production" Service**

*REG. U.S. PAT. OFF.

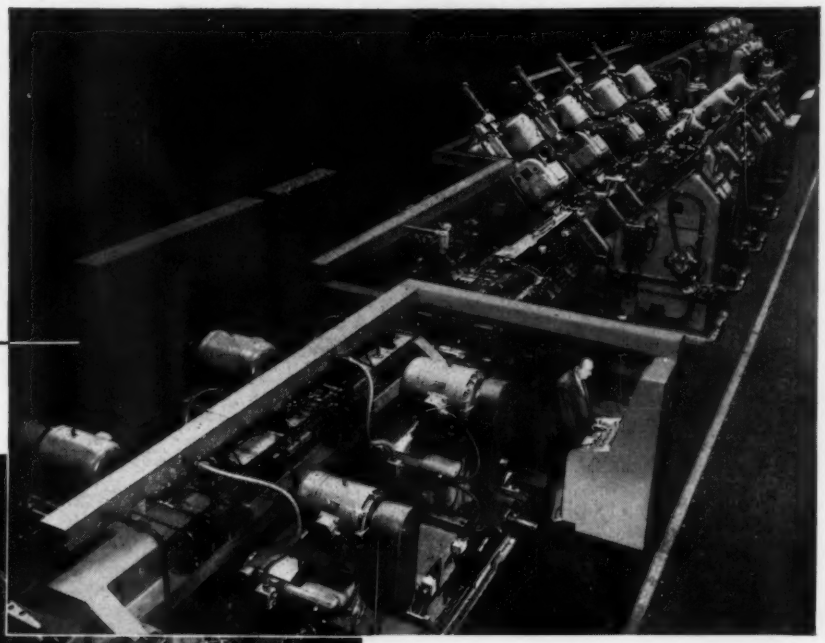
AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

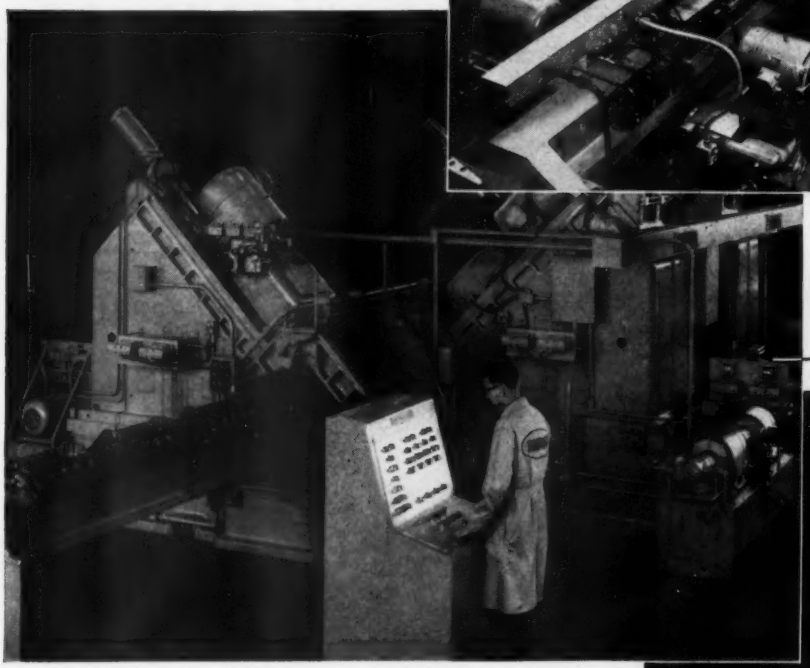




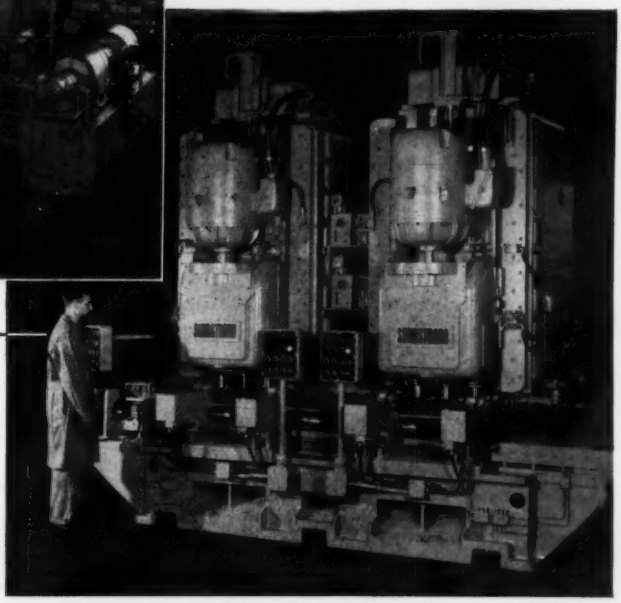


Three unit section of production line has twenty-nine stations for milling, drilling, reaming and checking operations on V-type engine blocks.





Four station finish boring unit for 8 cylinder V-type engine blocks.

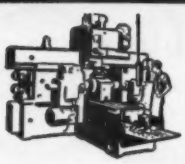


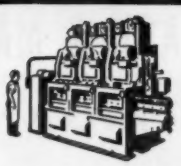
Six spindle two station unit for rough boring six cylinder straight-in-line engine block.

MORE FACTS

about Sundstrand "Engineered Production" are available in this booklet. Write for your copy today. Ask for bulletin 154.

TRIPLEX RIGIDMILS | SPECIAL MACHINES





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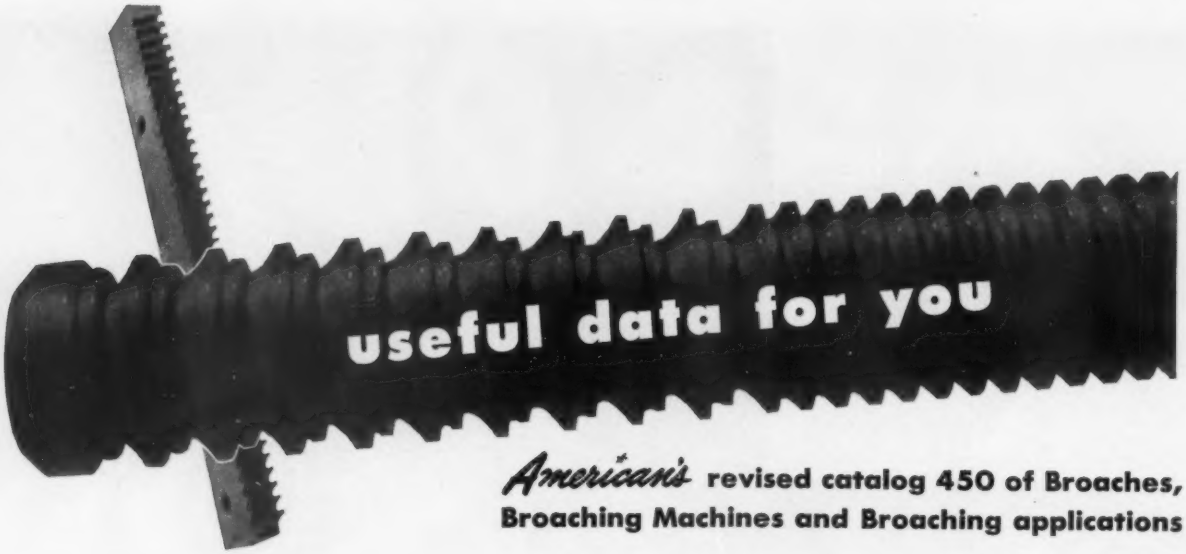

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American's **revised catalog 450 of Broaches, Broaching Machines and Broaching applications**

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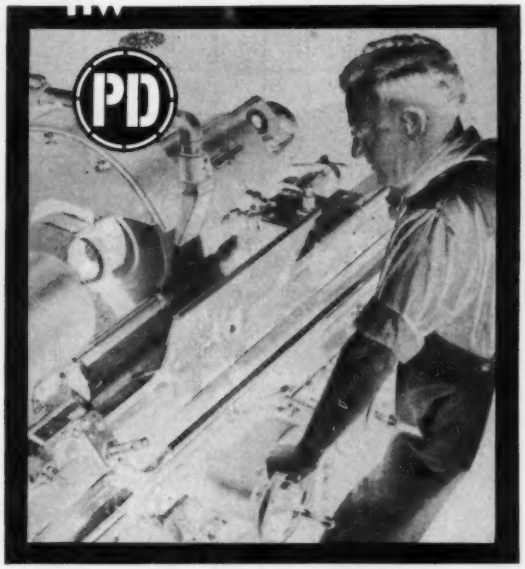

JUST AS A NEGATIVE guarantees you an exact duplication of a photograph each and every time, you are always assured a . . .

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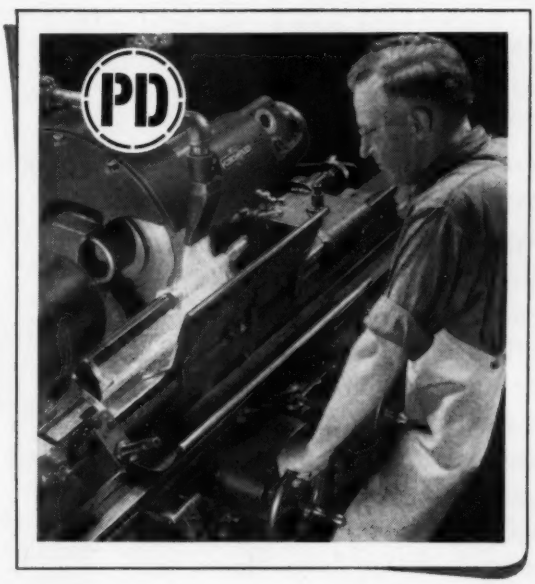

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PD Positive Duplication

No wonder the good news about Positive Duplication is causing so much excitement. For (PD) is an outstanding development in precision manufacturing and quality control that can *save you money* . . . and *increase your production.*

Through the CINCINNATI (PD) Manufacturing Process you are assured a Positive Duplication of the original wheel *every* time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS *are priced no higher than ordinary wheels.*

Investigate! Let us prove to you how CINCINNATI (PD) WHEELS can save you money and increase your production. Just contact us and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

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Grinding Wheels

A PRODUCTION-PROVEN PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

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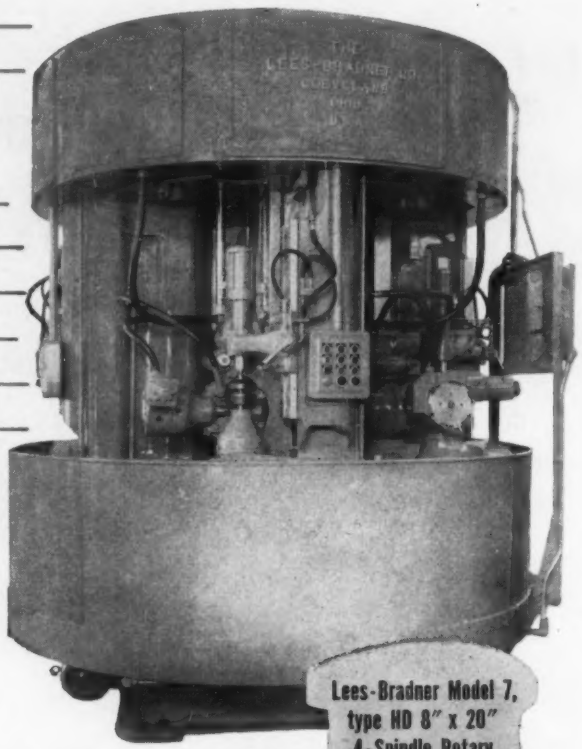
Sets the HOBBING pace for tomorrow

with 4 machines in 1



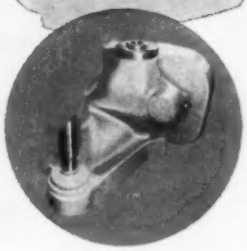
Lees-Bradner Model 7, type HD 8" x 20" 4-Spindle Rotary Hobber. Also available in single and 6-spindle models.

Here's a complete hobbing production line in one space-saving unit.

Actually the Lees-Bradner Model 7, Type HD 4-Spindle Hobber is four separate and independently operative machines in one. Each hobbing unit incorporates basically the same automatic, high-production features as the remarkable 7 type HD Single Spindle Hobber. This includes a heavier, more rugged headstock, heavy-duty column and a 10 H.P. motor.

This amazingly efficient machine not only saves valuable floor space but, with its pushbutton controls and automatic features, actually controls the operator thus reducing the chance for human error or slowdown. Chips and coolant are easily carried away from the headstock by the elimination of flat surfaces.

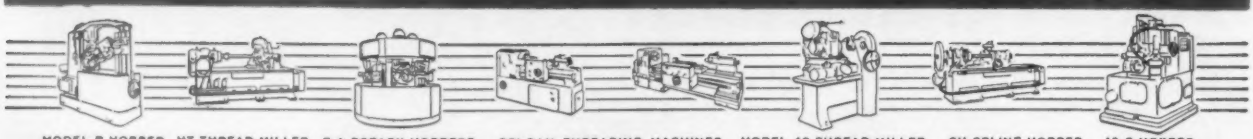
So, if your manufacturing space is valuable and high unit production important, ask your Lees-Bradner representative to give you the story on the ultra-efficient 4-spindle rotary hobber. Write or wire us direct for his name and address in your area.



View of new Type HD headstock with increased bearing surface between column and headstock, heavier casting, coolant and chip carry-away.

the LEES-BRADNER Company

CLEVELAND 11, OHIO, U.S.A.



MODEL R HOBBER HT THREAD MILLER 7-A ROTARY HOBBERS CRI-DAN THREADING MACHINES MODEL 40 THREAD MILLER SH SPLINE HOBBER 12-S HOBBER

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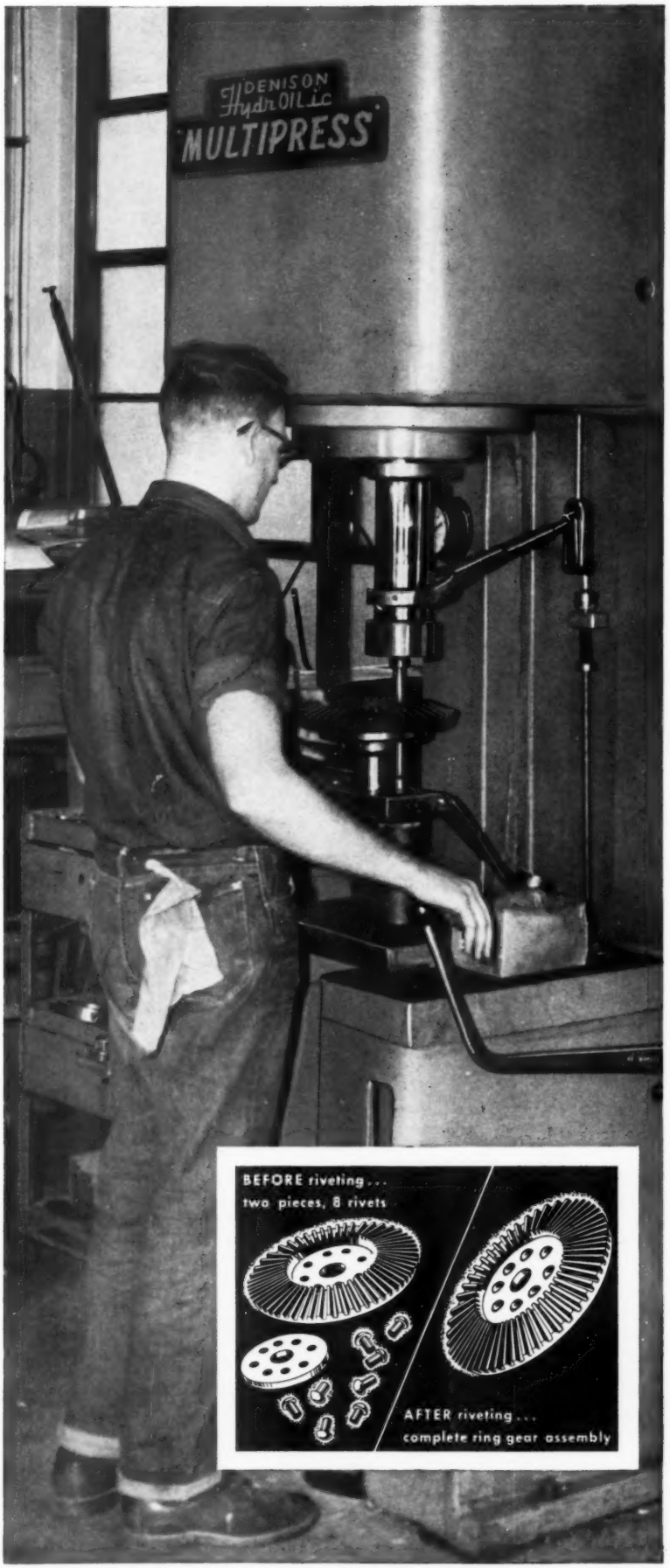

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At Barber-Greene Company, they've tripled production for riveting together two halves of a ring gear assembly.

With former hot rivet method, the best a three-man team could do was 10 assemblies an hour. The operation was slow, noisy. Distortion from heat made a boring operation necessary.

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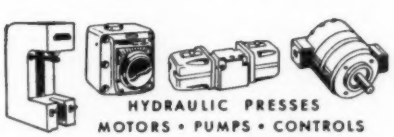

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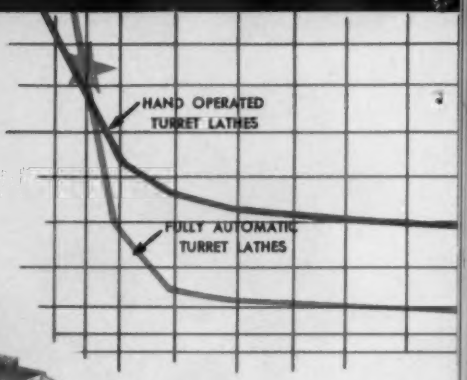
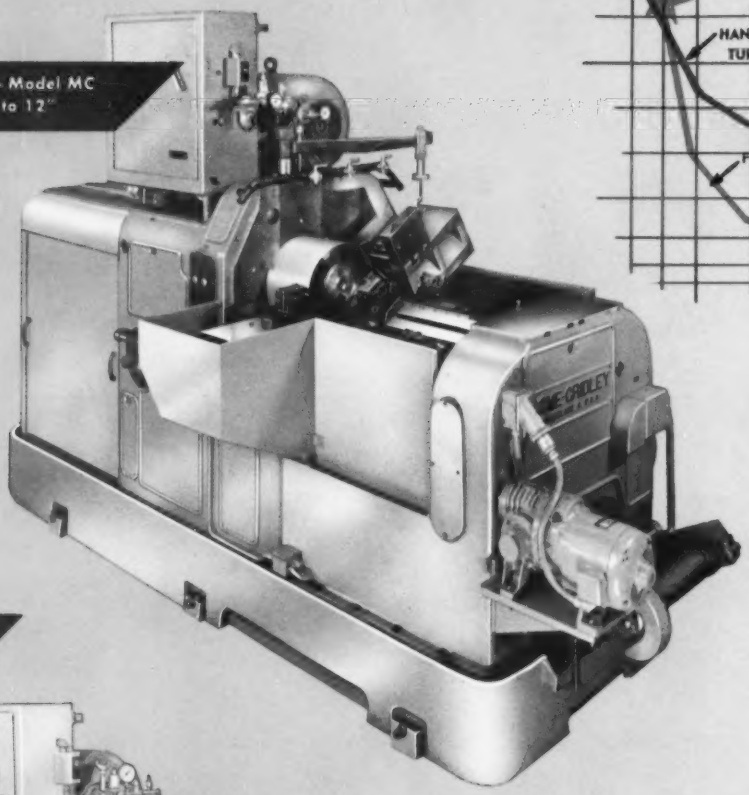
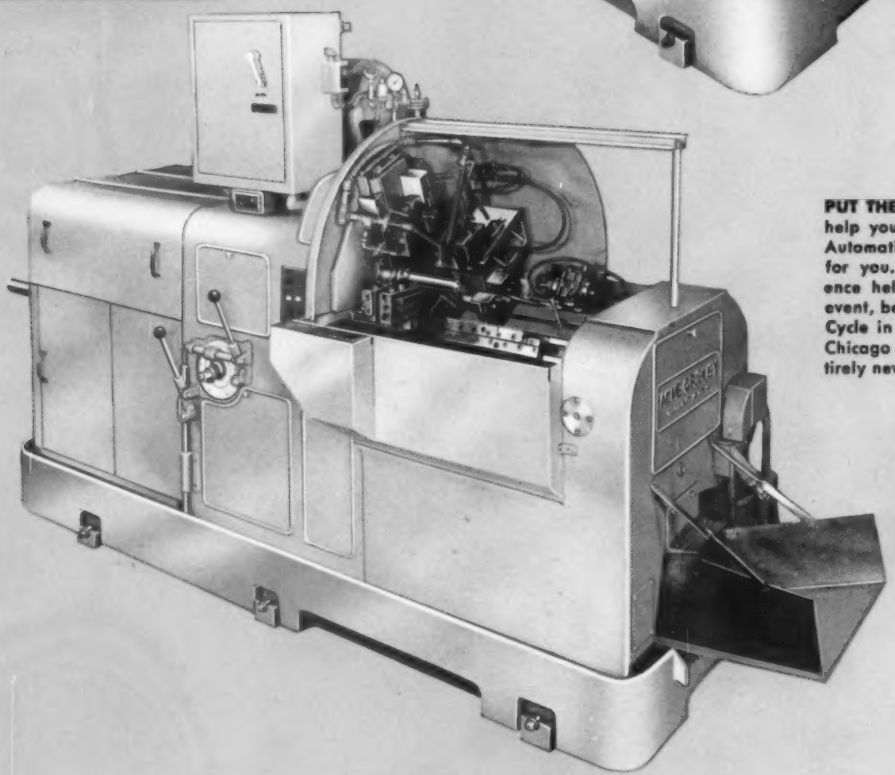


CHUCK TYPE — Model MC
Capacity—Up to 12"



BAR TYPE — Model M
Sizes: 3½", 4¾", 5½"



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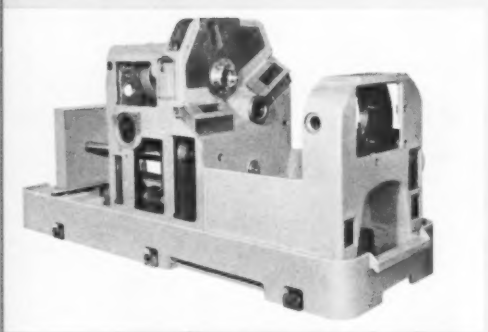
Fully Automatic

BAR OR CHUCK-TYPE TURRET LATHE

- **Actual job tests have shown that with Acme-Gridley Fully Automatic Turret Lathes you can profitably use automatic production on shorter runs than formerly was thought possible. The reason? Automatically Controlled Cycle.***

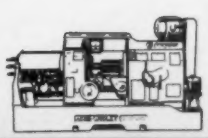
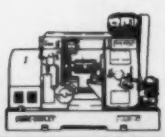
- **By completing the maximum number of operations in one *automatically-controlled* cycle — and doing it faster, more accurately and at the same predetermined rate throughout the entire run, tooling time becomes of less relative importance. *You get to the break-even point in cost per piece, sooner than you think.* And it doesn't require much imagination to visualize how these savings multiply on longer production runs.**

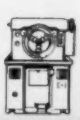


HUSKY BASIC FRAME: A well-balanced structural design with weight properly distributed to provide rigid support for tool slides and work spindle — sustaining alignment and accuracy at spindle speeds and feeds imposed by modern carbide and high speed tooling. Turret outer support, containing independent indexing mechanism, is secured to headstock by heavy side walls. A heavy column supports main drum shaft at other end of the pan.

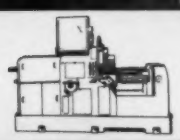
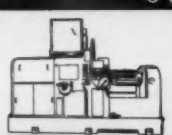
AUTOMATICALLY CONTROLLED CYCLE: Easy to set, easy to use. Accessibility of cycle control drum and toolslide camming provides quick job changeover. Convenience of controls and "working height" reduces operator fatigue. In the open tooling zone, each toolslide (cross slides and 5 turret slides) is carefully designed and positioned to provide maximum support for the tools without excessive overhang — on the turret, only the "working" slide advances to the work, providing closer support of tools and permitting wider cross slides to operate simultaneously without interference.

GREATER TOOLING ADAPTABILITY: Independent operation of each cross slide and turret slide permits balancing of correct spindle speed and tool feed for various cuts. Independent turret slide indexing permits overlapping operations — two or more shorter end working operations may be performed while forming cuts, requiring longer machining time, are simultaneously continued by the cross slides.



OUR JOB: to provide the *Right Machine* for **YOUR JOB**

Acme-Gridley 4, 6 and 8 Spindle Automatic Bar and Chucking Machines • Fully Automatic Turret Lathes (Bar and Chuck Type) • Hydraulic Thread Rolling Machines • Automatic Threading Tools • Switches • Solenoids • Contract Manufacturing.

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170 EAST 131st STREET • CLEVELAND 8, OHIO

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The ARMSTRONG Threading Tool takes interchangeable high speed steel form-cutters which require only flat top grinding to resharpen—always hold their true thread form.

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Every rise in labor costs, every added tax, every overhead burden, every increase in cutting steel prices, every new, more costly machine tool, all increase the importance of ARMSTRONG TOOL HOLDERS to profitable operation.

ARMSTRONG TOOL HOLDERS reduce direct tooling costs to an absolute minimum—"Save: All Forging, 70% Grinding, 90% High Speed Steel."

ARMSTRONG TOOL HOLDERS reduce tooling-up time to minutes, to the selection and adjustment of the holder and cutter.

ARMSTRONG TOOL HOLDERS permit increased speeds and feeds—produce more pieces per hour per machine tool.

ARMSTRONG TOOL HOLDERS are efficient for they embody a perfection gained by over 50 years of specialization in the development and refinement of tool holders.

ARMSTRONG TOOL HOLDERS are inexpensive because they are quantity produced by modern methods, for a world market . . . are used by over 96% of the machine shops and tool rooms . . . are carried in stock for your convenience by all industrial distributors of consequence.

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... and with high speed steels the champion's always REX

Compare the freckles and you'll pick the champ. And it's easy to spot the champ in high speed steels, too, for Crucible REX® has been the *standard of comparison* for over half a century.

Prove the reasons for REX's superiority in your own shop. You'll like its hardenability... response to heat treatment . . . fine tool performance. Like thousands of other users, you'll agree *you can't find a high speed steel to outperform REX.*

Ask for REX, a *prescription-made* Crucible product, at Crucible warehouses or leading distributors from coast to coast. *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 30, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

WINTER TAPS HAVE BALANCED Action

To lower your cost of tapped holes, put Winter BALANCED ACTION Taps to work for you. ALL have uniform flute contours; exact flute spacing; accurate and concentric chamfers; and precision chip driver contours.

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You depend on *the cutting edge of the tool* to give you long hours of dependable service. Nationals hold their cutting edges. They keep your grinding room costs at a minimum too.

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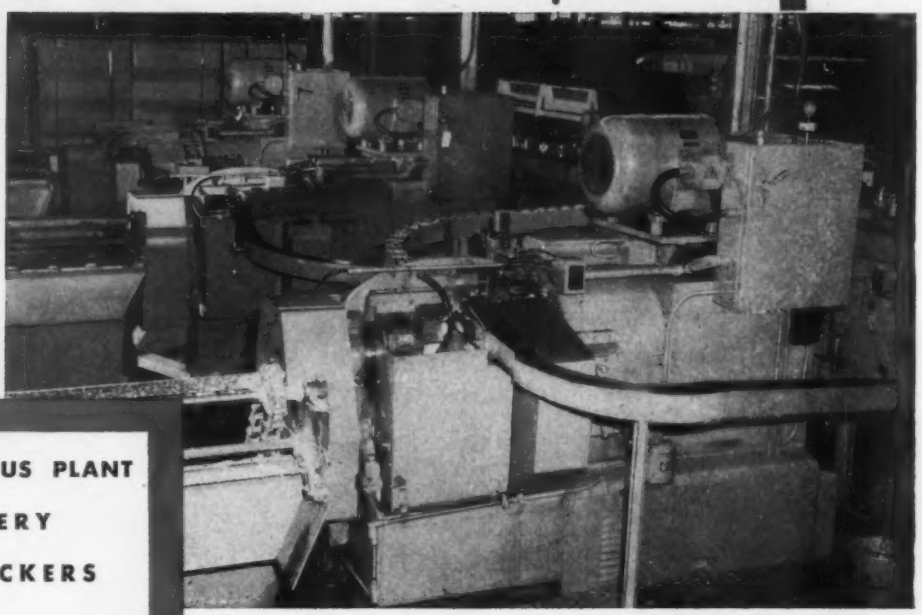
. . . IF IT'S A HIGH PRODUCTION PROBLEM . . .

ASK BAIRD ABOUT IT



ANOTHER WORLD-FAMOUS PLANT
INSTALLS BATTERY
OF BAIRD CHUCKERS

The photo above shows four of a battery of eight Baird 6-spindle automatic Chucking Machines performing the complete turning operations on aluminum alloy pistons . . . including automatic feed and discharge.

The Plant Manager says, "Previous methods of finish-turning required *four* separate operations. Now, the same results are attained in one operation . . . faster and with less chance of error." Cutting speed is 1332 to 1350 ft. per minute . . . feed per revolution .018 to .025. Actual cutting time at each station approximately 5 seconds . . . complete cycle 7.36 seconds.

Baird Chuckers are designed and built to insure positive, continuous, production . . . tooled for precision at low unit costs that give you a definite, competitive advantage.

As automation of large plants advances, Baird automatics can play a vitally important part in your production lines. And Baird engineers, highly experienced in special tooling techniques, offer you solutions for tough production problems. It will pay well to "ask Baird about it."

Write to Dept. AM

THE BAIRD MACHINE COMPANY
STRATFORD CONNECTICUT

WHERE YOU WILL GET THE HELP OF SPECIALISTS ON THESE ESSENTIAL PRODUCTION PROBLEMS:

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

ONE OF A SERIES

You Get Many Benefits
By Specifying VICKERS Hydraulics

Reduced Maintenance Costs

Vickers Oil Hydraulic Equipment is built to minimize maintenance . . . has an outstanding performance record. Nevertheless, Vickers recognizes that sooner or later any piece of machinery requires overhaul. So we have developed a service department of exceptional efficiency . . . one that is convenient for you by reason of full time factory-trained service men working out of our offices from coast to coast.

Shown below are several of the practical aids provided to assure you quick and economical service on Vickers Hydraulics.

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SPARE PARTS RECOMMENDATIONS

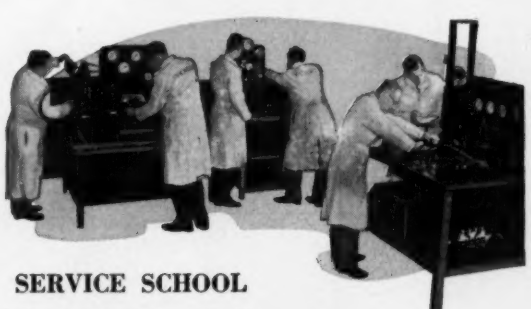
Our service men will study your situation and make practical recommendations on your spare parts inventory . . . will check your inventory and provide you with printed lists of parts usually required.

SERVICE KITS

Packaged repair kits for many Vickers products are available. These provide all needed parts for quick repair in the field and at minimum cost. In addition, these kits simplify stock problems by reducing the number of loose parts.

PREVENTIVE MAINTENANCE

Our service men will gladly set up for you an effective program of preventive maintenance on a timetable basis. This avoids costly down time and keeps maintenance costs at a minimum.

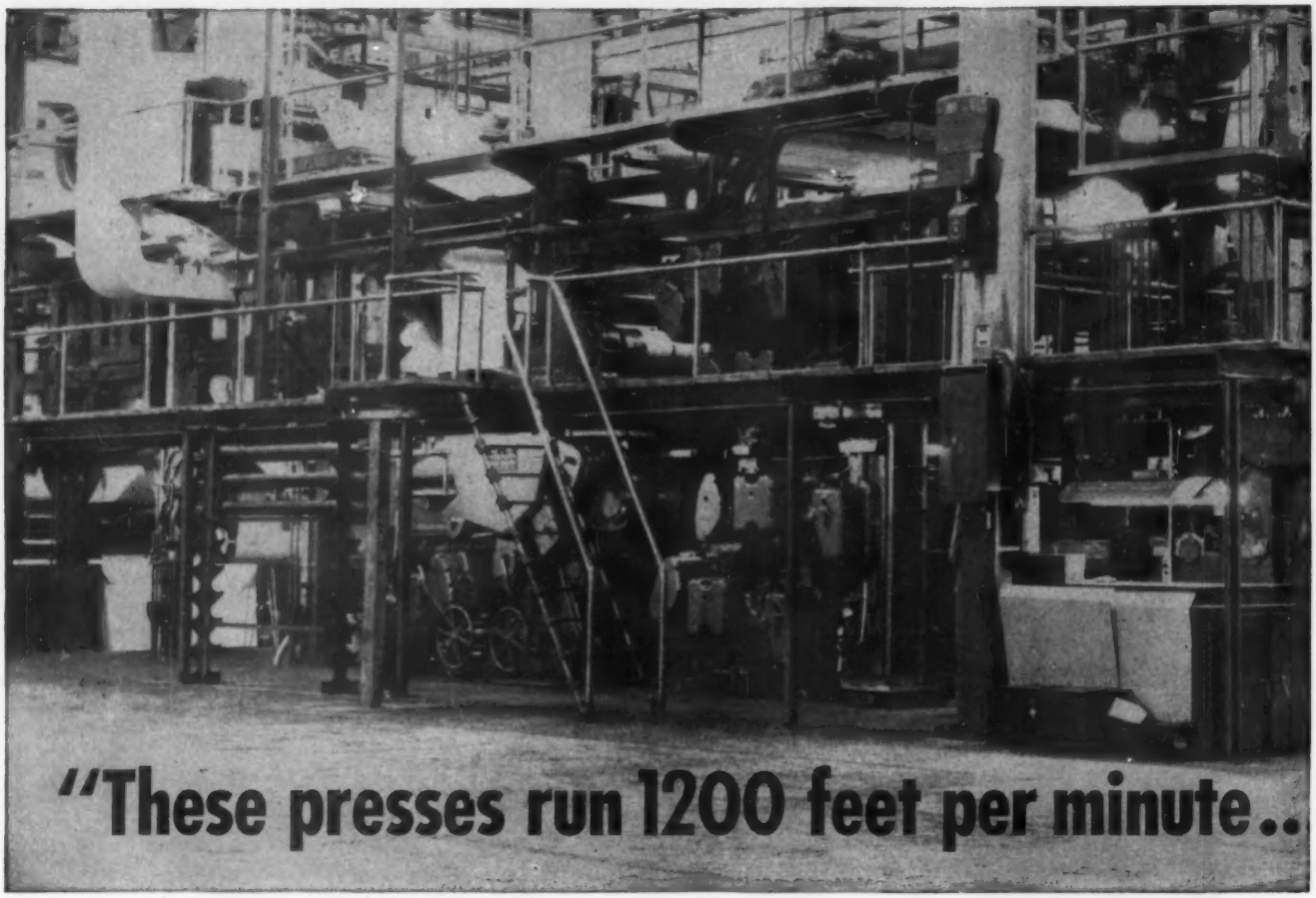


SERVICE SCHOOL

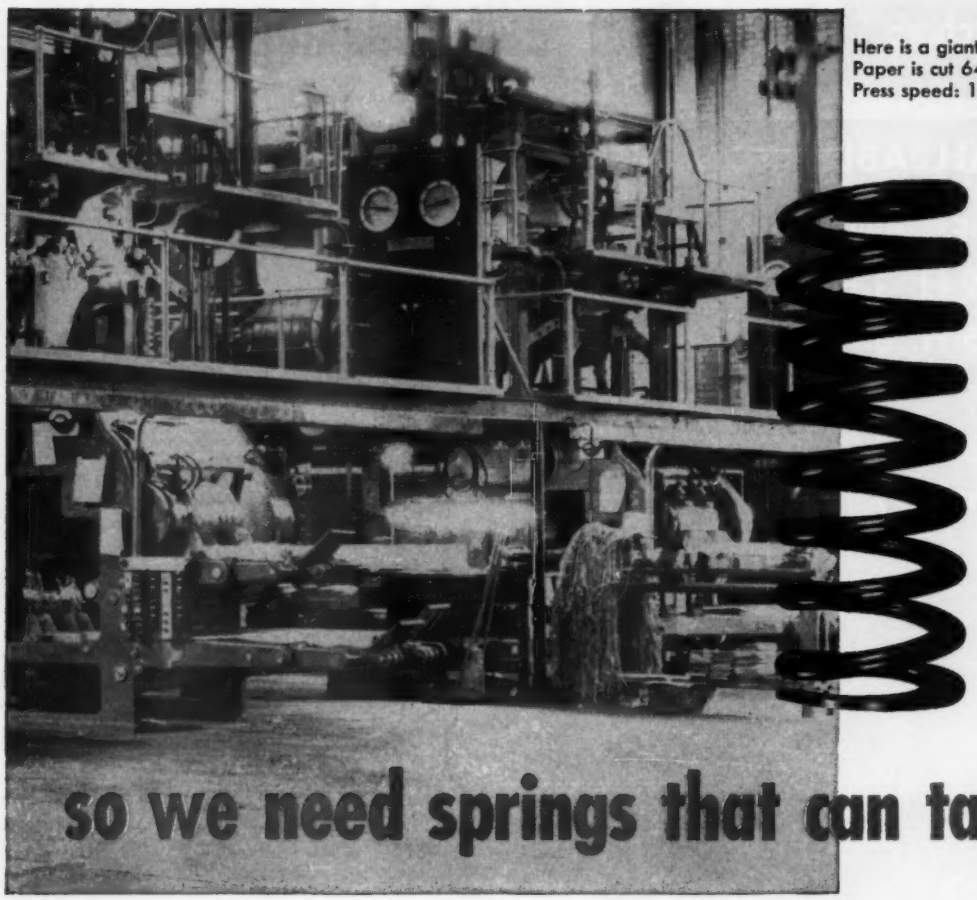
Vickers maintains a Hydraulics Training School for engineering, maintenance and service personnel of both original equipment manufacturers and their customers. For further information, please contact Product Service Department directly.

7143

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921



Cutting knife enters the slot visible in these knife assemblies. Springs maintain pressure on the paper during cut.



Here is a giant multicolor magazine press in action.
Paper is cut 640 times per minute.
Press speed: 1200 feet per minute.

so we need springs that can take it"

says Goss Printing Press Company, world's largest manufacturer of newspaper, magazine and rotogravure presses

● 74% of the world's daily newspapers are printed on Goss equipment. Some of the presses are nearly a city block long—giant, roaring machines that gobble up newsprint at the rate of 1200 to 2000 feet per minute. Many of the largest magazines also are printed on Goss presses, which run up to 1200 feet per minute.

At one end of the press is the cutting cylinder, where the paper is cut "on the run." 640 times a minute, the sharp steel knife snaps in and out between two spring loaded fibre "cushions" that hold the paper against the cutting cylinder. When the knife retracts, the springs push the cushions back out of the way.

According to Mr. William Zimmer, Asst. Chief Engineer, "Inferior springs would fail, jam the cutting cylinders, wedge the folding mechanism, and cause severe damage. I don't think that a spring could have a tougher job; but we've been using American Quality Springs for 20 years with excellent results."

American Quality Springs are available in any size, any quantity, any steel, style or finish—including flat wire and special shapes. Just get in touch with your American Steel & Wire representative.

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USS American Quality Springs

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UNITED STATES STEEL

"Operations Kingsbury" in custom-built indexing machines

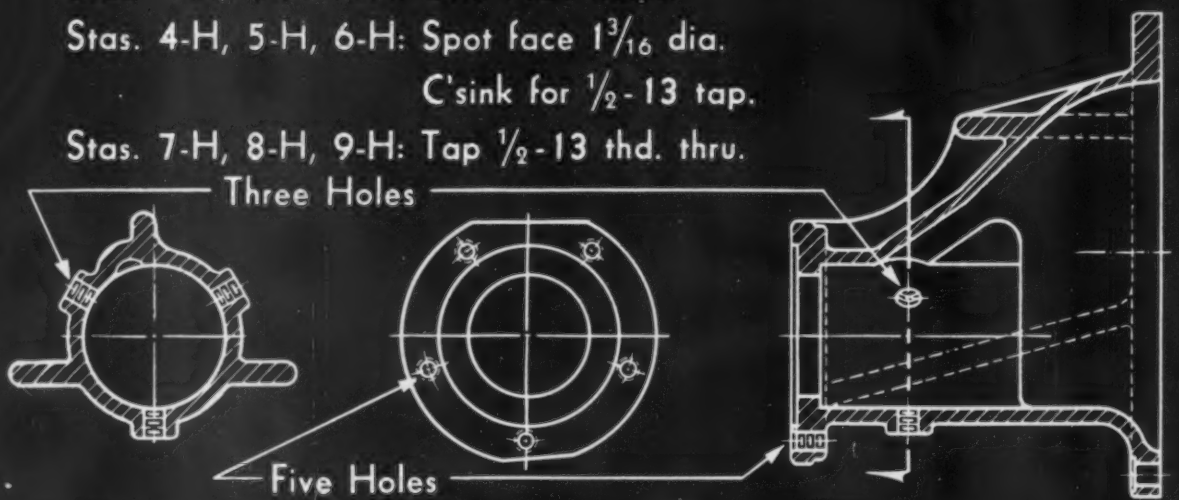
MALLEABLE IRON DIFFERENTIAL CARRIER

240 pieces per hour gross. 24 operations. 8¢ per piece.

Stas. 1-H, 2-H, 3-H: Drill .421 holes.

Stas. 4-H, 5-H, 6-H: Spot face $1\frac{3}{16}$ dia.
C'sink for $\frac{1}{2}$-13 tap.

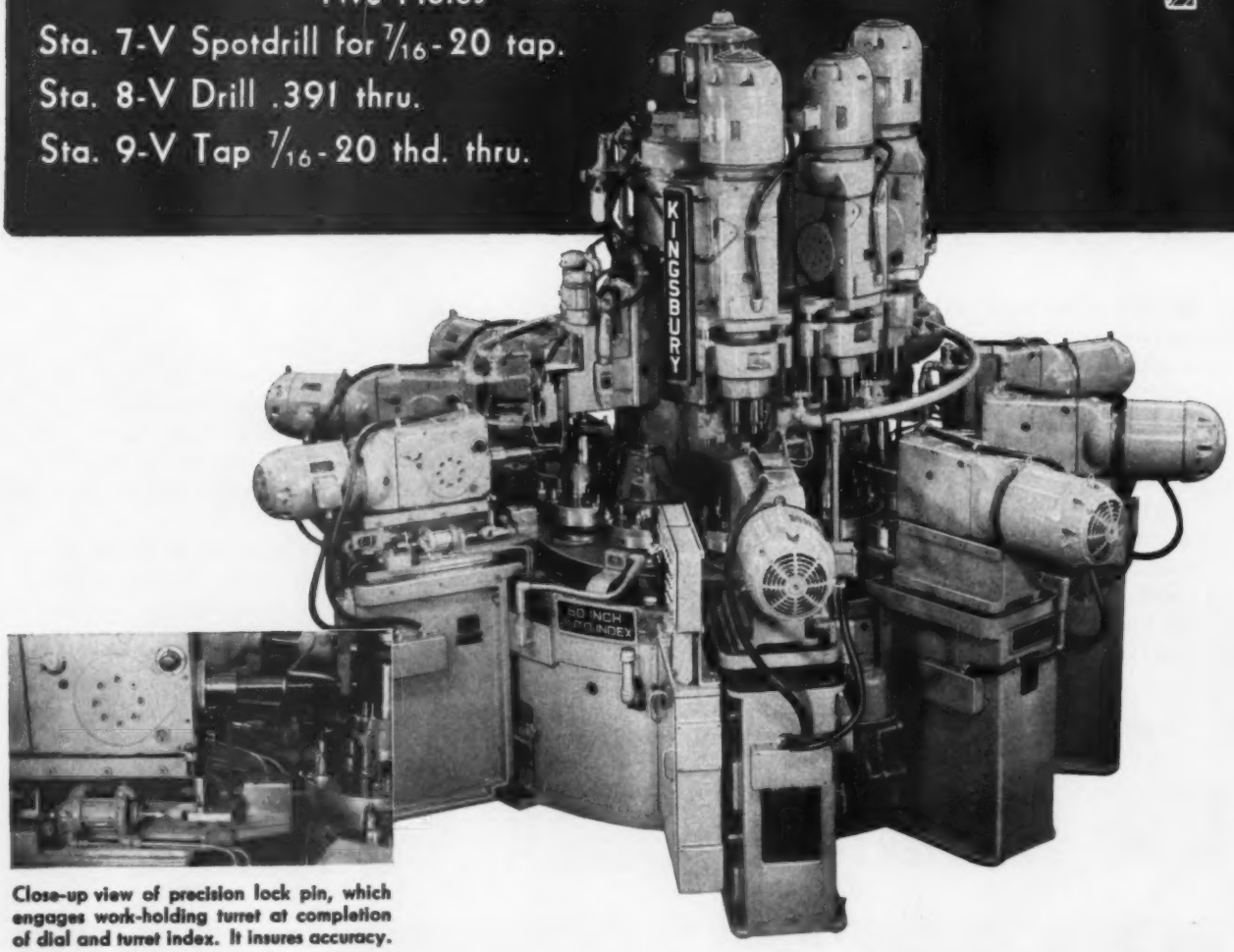
Stas. 7-H, 8-H, 9-H: Tap $\frac{1}{2}$-13 thd. thru.



Sta. 7-V Spotdrill for $\frac{7}{16}$-20 tap.

Sta. 8-V Drill .391 thru.

Sta. 9-V Tap $\frac{7}{16}$-20 thd. thru.



Close-up view of precision lock pin, which engages work-holding turret at completion of dial and turret index. It insures accuracy.

can mean uniform parts at low cost for you

The Malleable Iron Differential Carrier (at left) calls for eight tapped holes. The five vertical holes require three operations, and present no special problem. But . . . the three horizontal holes also require three operations each — and these holes are spaced 120° apart.

A central column machine is used. It has a 60-inch index table with nine stations (one for loading and unloading). Each of the work-holding fixtures is mounted on a rotating turret which turns 120° as the table indexes. For accuracy, the turret is locked in position as shown in the detail photograph. Work is clamped onto the fixture at each work station.

The Cast Iron Manifold Heat Control Assembly (below) calls for precision machining *and an assembly operation*. This work is *all* accomplished in one production cycle on machine illustrated. The table indexes through five stations (one for loading and unloading). Operations are performed by four horizontal units. At Stations 1, 2 and 3 the hole is drilled, countersunk and reamed. At Station 4 the pins (fed into a chute and released by an escape mechanism) are pressed into the prepared hole by a specially-designed hydraulic ram.

Machines *designed and built* by Kingsbury use work-tested Kingsbury units such as heads, index mechanisms, cutting tool guides, synchronized controls, bases, etc. *But the work-holding fixtures are special — designed for each part.* They have to be, for unless the part can be located correctly and held firmly, required *accuracy* cannot be obtained. And unless the fixtures can be loaded and unloaded quickly and easily, *production* will suffer.

It's a job that requires specialized skills and experience. *We have both.*

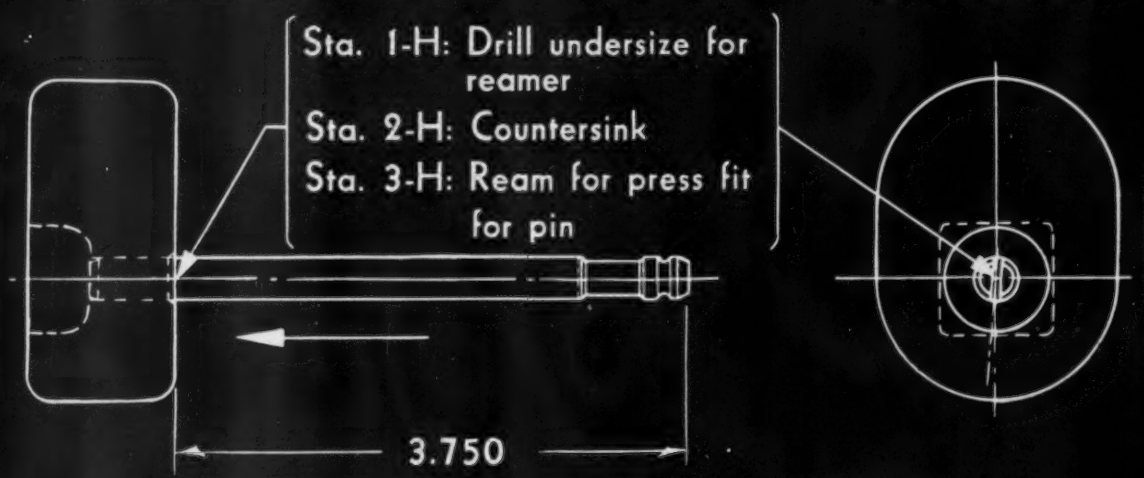
Kingsbury Machine Tool Corp.
110 Laurel Street
Keene, New Hampshire

KINGSBURY

AUTOMATIC DRILLING AND TAPPING MACHINES
for Low Cost High Production

CAST IRON MANIFOLD HEAT CONTROL ASSEMBLY

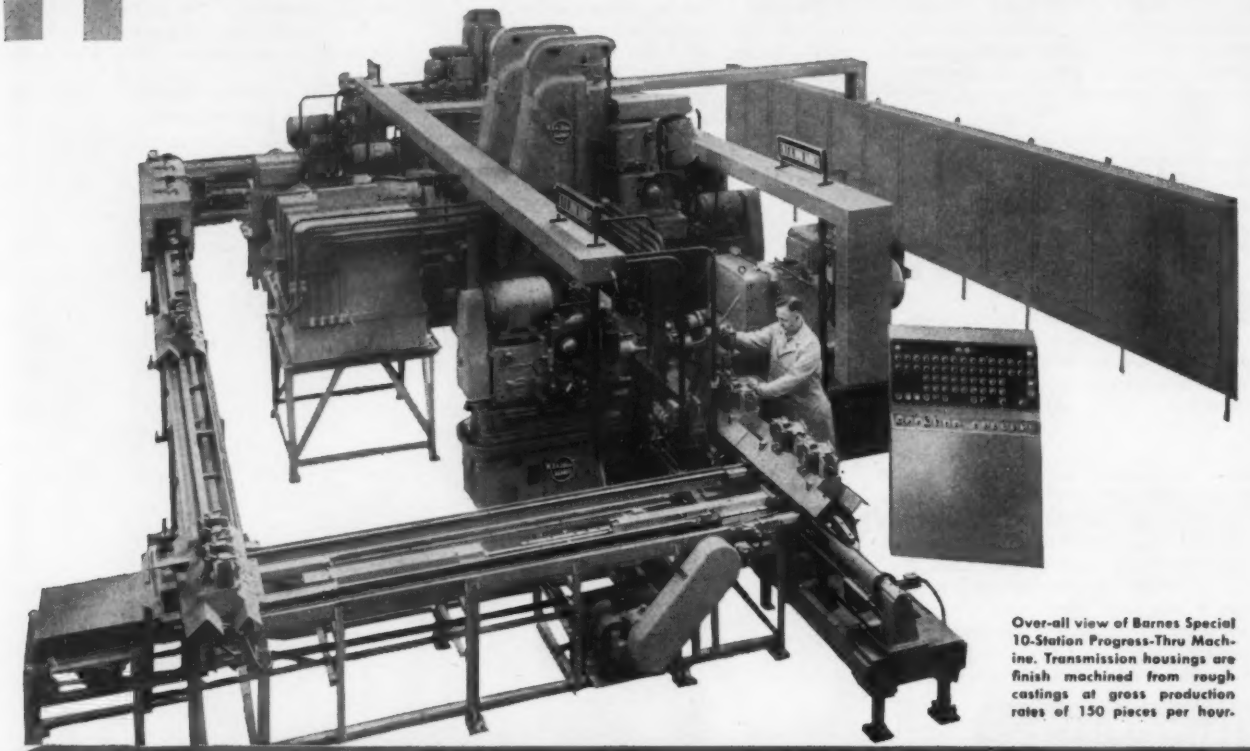
300 pieces per hour gross. Four operations. $2\frac{2}{10}$¢ per part.



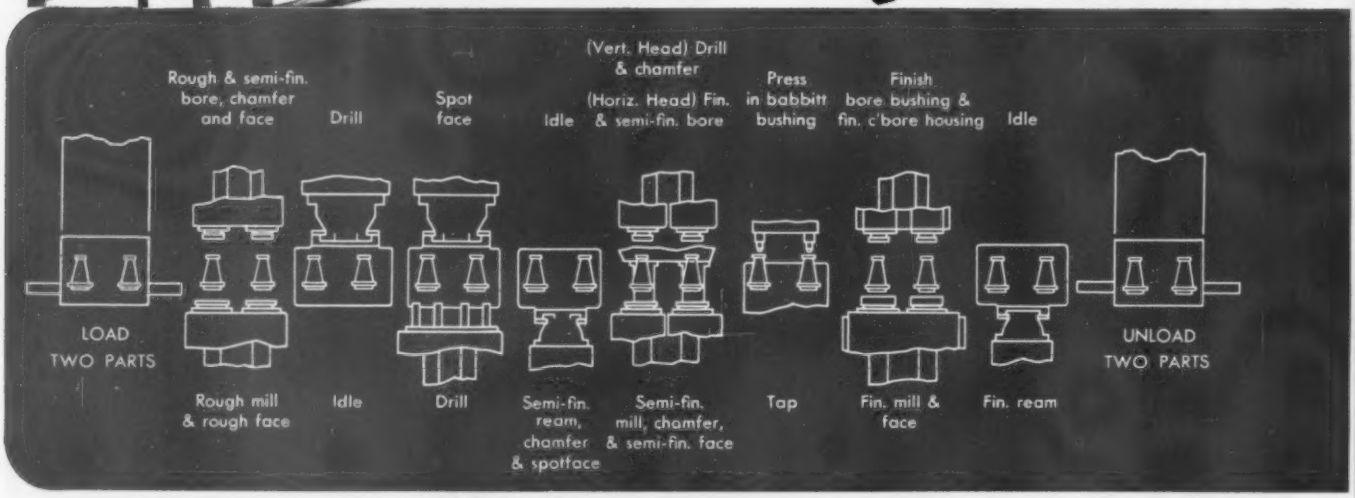
Sta. 4-H. Press pin in place with hydraulic ram assembly.

TRANSMISSION EXTENSION

HOUSINGS NOW MACHINED COMPLETE



Over-all view of Barnes Special 10-Station Progress-Thru Machine. Transmission housings are finish machined from rough castings at gross production rates of 150 pieces per hour.



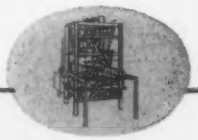
▲ Schematic drawing of machining operations. Total concentricity on all operations does not exceed .002". Housings are held in transfer plates which are located by two hydraulically actuated dowels and clamped hydraulically at each machining station.

Builders of Better Machines Since 1872

W. F. & JOHN BARNES

Special Machine Tools

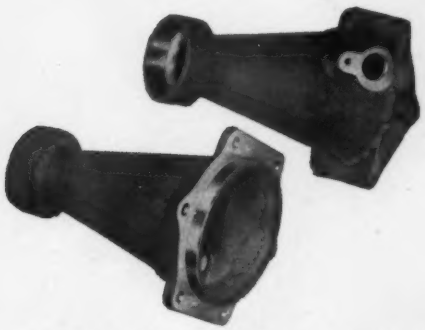
Special Conveyor Units



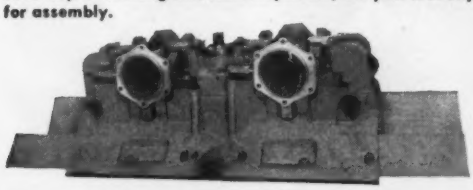
Special Process Equipment

MULTIPLE SPINDLE DRILLING • BORING • TAPPING MACHINES

FROM ROUGH CASTING TO FINISHED PART



Transmission extension housings are finish machined in automatic cycle from rough casting to finished workpiece. After rapid washing and final inspection, the part is ready for assembly.



View of workpieces in special transfer plate fixture. Both housings are located and accurately positioned by means of dowels and screw-operated V-block clamps.

ON

W. F. & JOHN BARNES SPECIAL 10-STATION PROGRESS-THRU MACHINE

Here is another typical example of how W. F. & John Barnes Six-Point Machine Tool Building Service has helped increase production efficiency for a leading automobile manufacturer. All machining operations on transmission extension housings are now combined in one Special Barnes 10-Station Progress-Thru Machine at a production rate of 150 pieces per hour. Two operators, one at the loading end and the second at the unloading end, load and unload housings on transfer plates which carry workpieces through the entire machining cycle. Operations include boring, facing, milling, drilling, reaming, automatic press-in of babbitt bushings, and combination finish bore babbitt bushing and finish counterbore housing.

Whether your production requires large or small machines, you'll find the coordinated services at Barnes can help you solve problems quickly and efficiently.

Closeup of station seven where babbitt bushings are automatically pressed-in to the small end of the housings. Bushings are hopper loaded by operator at the unloading station.

BARNES' COORDINATED 6-POINT MACHINE TOOL BUILDING SERVICE INCLUDES:

1. **SPECIALIZED MANUFACTURING FACILITIES**—75-year background, large well equipped plant efficiently tooled to build high production machines.
2. **SPECIAL HYDRAULIC EQUIPMENT**—designed and built to meet JIC standards. Individually engineered units assure smooth, dependable actuation for every requirement.
3. **SPECIAL ELECTRICAL EQUIPMENT and CONTROLS** — individually designed and built for maximum safety and ease of control, with circuits that assure the most dependable coordination of all machine functions.
4. **SPECIAL GAUGES, FIXTURES, TOOLS**—designed for each individual machining problem, assure accuracy of operations at high production speeds.
5. **SPECIAL HANDLING AND CONVEYOR EQUIPMENT** — designed and built to reduce work handling, effect maximum safety and efficiency.
6. **COORDINATED DESIGN AND ENGINEERING**—Mechanical, Hydraulic, Electrical, Process, Tool, and Fixture Engineers work together at Barnes. Team-work solves complex problems quickly.

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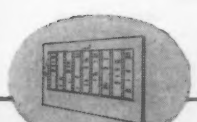
Ask for free booklet "Coordinated Machine Engineering" describing the scope of Barnes machine tool building service.

W. F. & JOHN BARNES COMPANY

MACHINE TOOL DIVISION

401 SOUTH WATER STREET, ROCKFORD, ILLINOIS



Special Electrical Controls

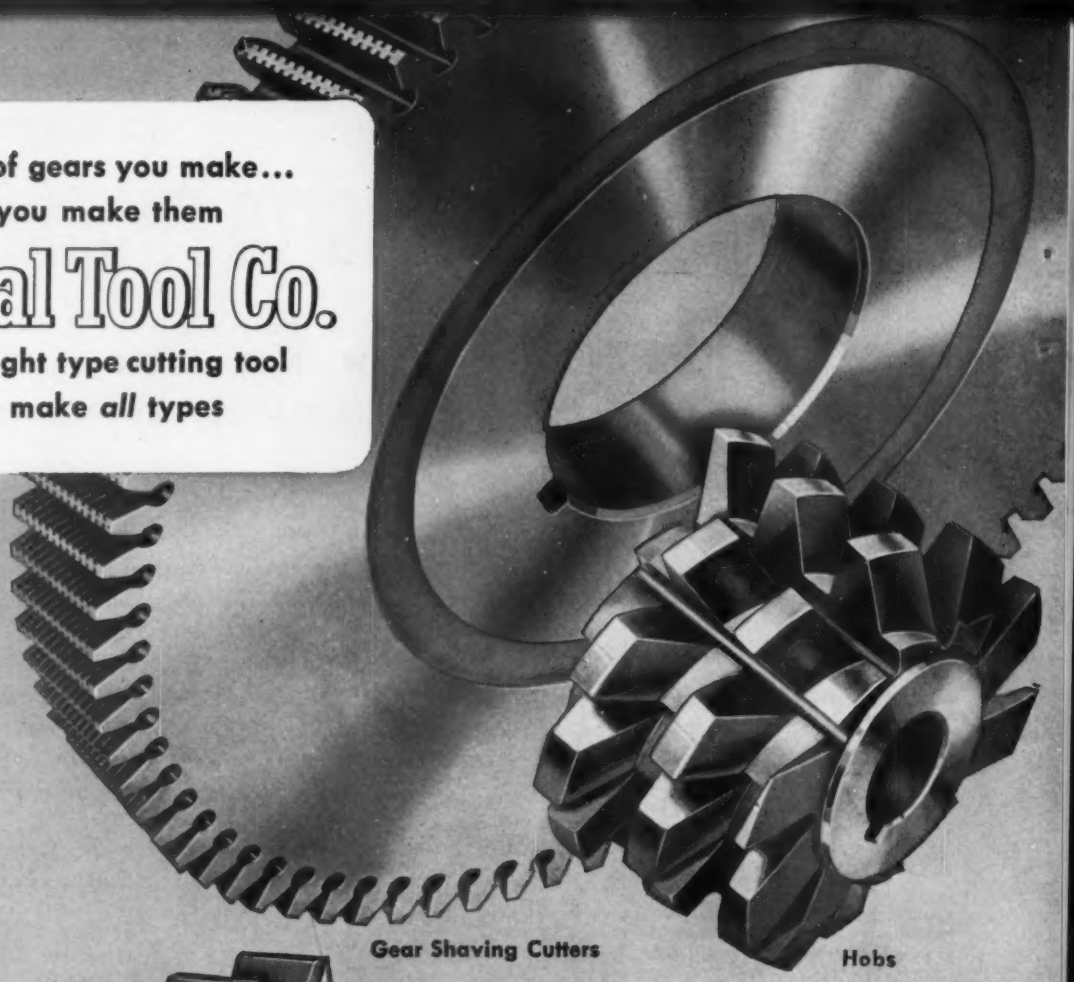
Food Machinery

AUTOMATIC PROGRESS-THRU AND TRANSFER TYPE MACHINES

Whatever kind of gears you make...
Whatever way you make them

National Tool Co.

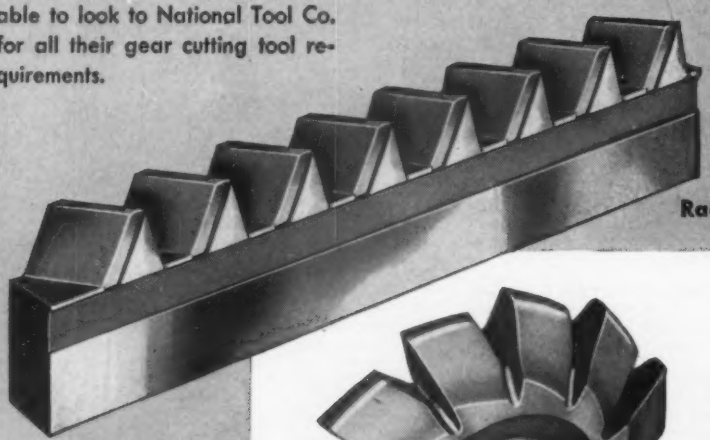
can supply the right type cutting tool because we make *all* types



Gear Shaving Cutters

Hobs

National Tool Co., with 50 years experience in the manufacture of special cutting tools, makes *all* varieties of gear cutting tools for *all* types of spur, helical and worm gears—as well as for sprockets and splines. Whatever your gear requirements—large or small—National engineers can help you decide the most efficient method of producing them. Many gear manufacturers have found it profitable to look to National Tool Co. for all their gear cutting tool requirements.



Rack Type Gear Shaper Cutters

Gear Shaper Cutters

Involute Gear Cutters

Master Gears

Herringbone Gear Cutters

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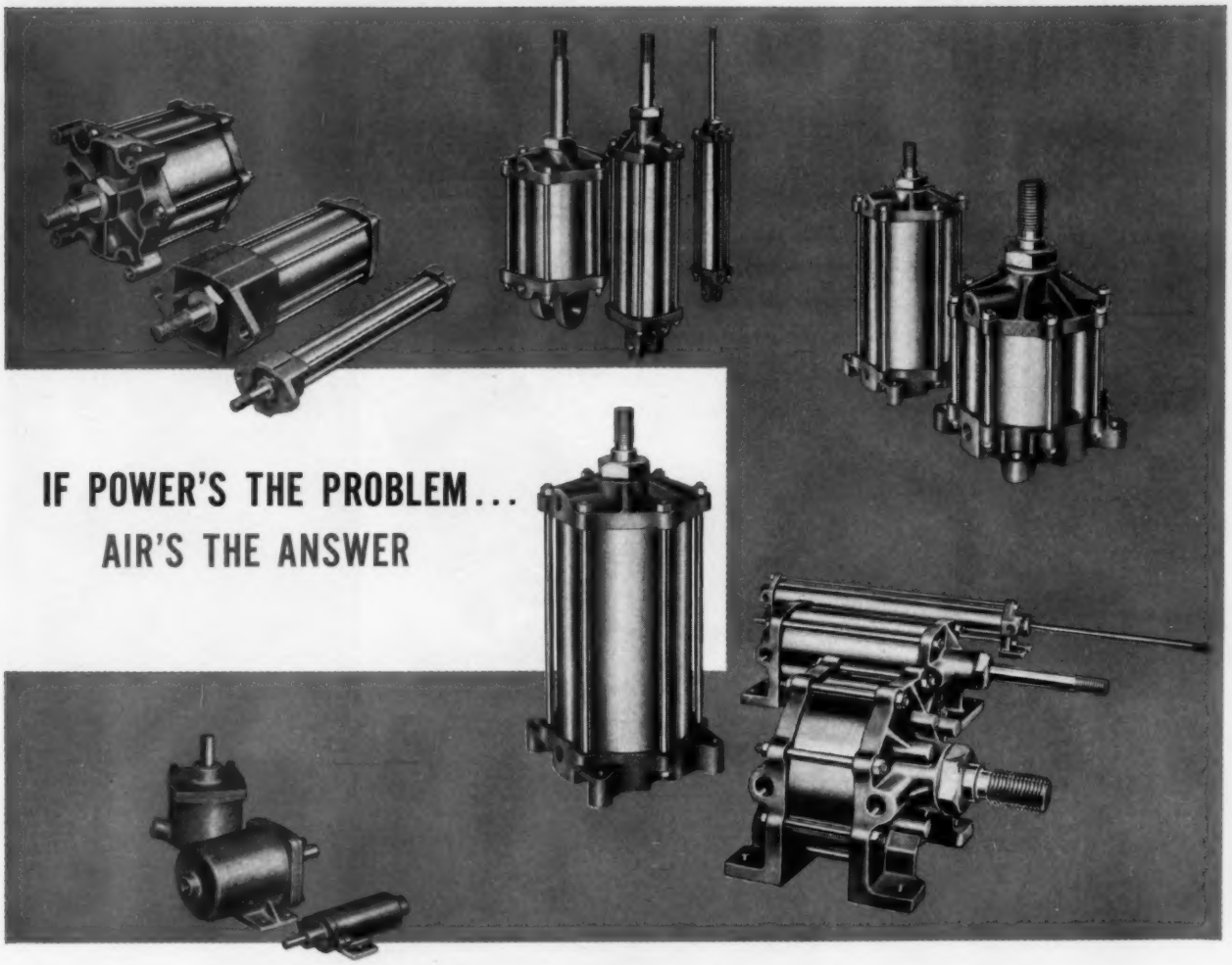

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There is a Schrader Air Cylinder with power enough to meet any application. Ideally suited to pushing . . . pulling . . . lifting . . . lowering . . . wherever repetitive operations are required —Schrader Cylinders are used in innumerable applications in industries of all types.

Schrader has a complete line of cylinders that will meet any requirement. They are available in single or double acting, in bores up to 8" diameter, in any stroke, and in any type of mounting.

Schrader Air Cylinders will deliver controlled low-cost power to eliminate manual effort and for incorporation in automation designs. They make hard work easy and speed up production.

Don't forget, the complete Schrader line includes operating and control valves of every type, as well as all other compressed air accessories for air systems.

Write for Schrader Cylinder Specification Data or for information on the complete line of compressed air accessories.

Schrader
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The complete Schrader line of pneumatic accessories includes everything you need

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Division of Scovill Manufacturing Company, Incorporated
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I am interested in more information on_____

Name_____ Title_____

Company_____

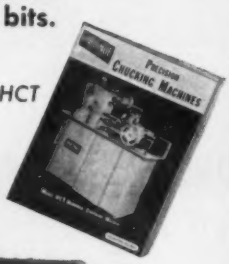
Address_____

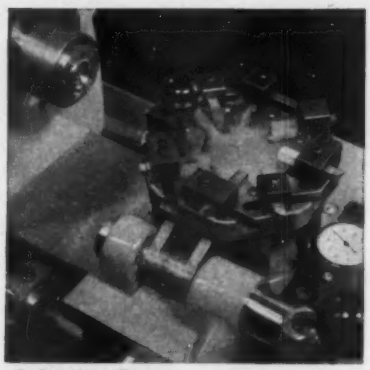
HARDINGE
ELMIRA, N.Y.

PRODUCTION
With Tool Room Accuracy

Hardinge Precision Chucking Machine HCT finish diameters, recesses, shoulders, back faces, front faces, and cuts precision threads in *one setting — all concentric* with each other. Tooled inexpensively with standard tool bits.

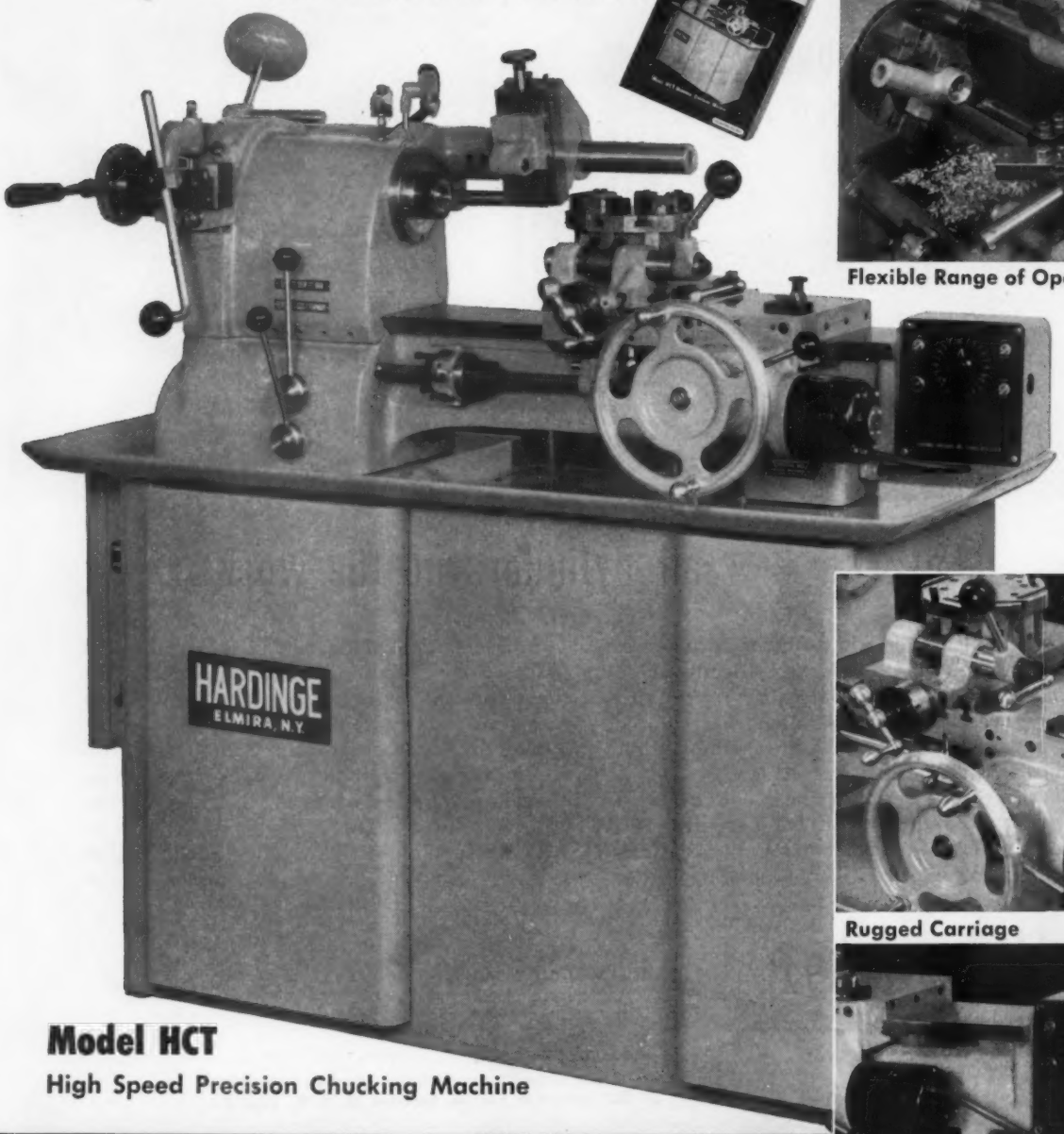
For complete information write for Bulletin HCT



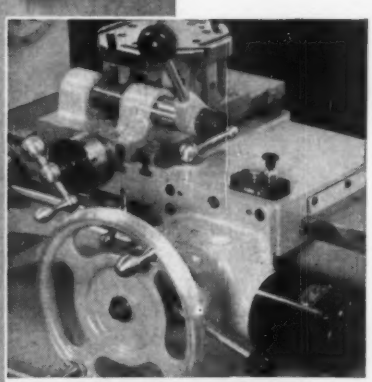


8-Station Turret

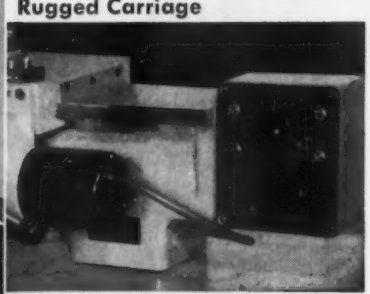
Flexible Range of Operation



Model HCT
High Speed Precision Chucking Machine



Rugged Carriage

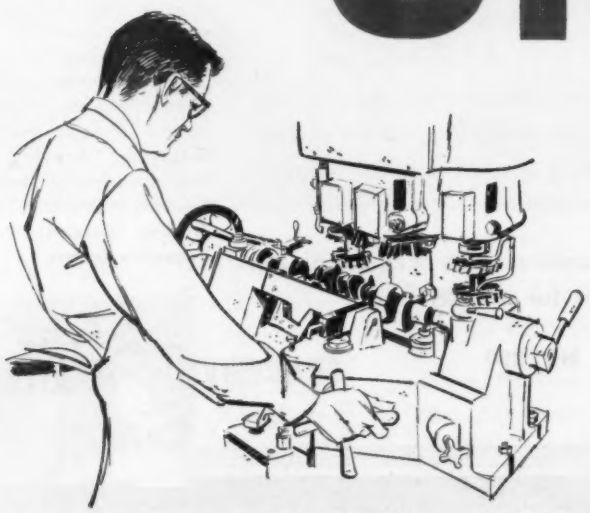


Independent Variable Carriage Feed

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

OFFICES IN PRINCIPAL CITIES. Export Office: 269 Lafayette St., New York 12, N. Y.

IN THE METAL WORKING INDUSTRY, IT'S UNION



UNION DISTRIBUTORS SERVE THE NATION

FOR
- SPEED
- ECONOMY
- RELIABILITY
- PERSONAL CONTACT

CALL YOUR UNION DISTRIBUTOR

UNION TWIST DRILL COMPANY · ATHOL, MASSACHUSETTS

OWNERS AND OPERATORS OF: S. W. CARD MANUFACTURING CO. DIVISION, Mansfield, Mass.
BUTTERFIELD DIVISION, Derby Line, Vermont and Rock Island, Quebec

THE NEW

LOW COST

SINGLE DISC JOHNSON CLUTCHES

This is "it" . . . a Single Disc clutch that stays cool on the job . . . in both horizontal and vertical installations. The answer is "Separator Springs," the same feature that has popularized our Maxitorq Clutch.

If extreme compactness is not an essential, the Johnson Single Disc Clutch will meet or beat all competition . . . for applications in the field of light machinery . . . as a better clutch at a competitive price (see typical applications at right).

Available are two capacities, No. 350 — 3 h.p. max. and No. 450 — 6 h.p. max. A simple hex key frees the knurled ring for easy manual adjustment. The "floating" disc prevents drag, abrasion, and heating in neutral. And several driving combinations may be obtained, including V-belt.

For positive control of power transmission in its field, the Single Disc Johnson is tops. Write Dept. AM-4 for complete specs.

SEND FOR BULLETIN NO. 250

APPLICATIONS

Accessory Drives, Air Compressors, Bag Making, Boat Drives, Bread Wrapping, Chain Drives, Combines (farm), Conveyors, Crop Seeders, Cultivators, Dusting Machines, Feed Grinders, Floor Scrubbing, Fruit Cleaners, Gasoline Engines, Generator Drives, Hay Balers, Hoists, Loaders, Lawn Mowers, Milk Coolers, Mixing Machines, Motor Scooters, Packaging Machines, Paper Shredders, Power Fans, Power Saws, Power Take-offs, Pumping Equipment, Sand Spreaders, Sewing Machines, Spraying Equipment, Textile Machinery, Threshers (small), Tobacco Machinery, Tool Grinders, Tractors (garden), V-Belt Drives, Vegetable Sorters.

2CJ55

THE CARLYLE JOHNSON MACHINE COMPANY
MANCHESTER • CONNECTICUT

Ruggedness and Refinement

These two things you might not expect to find combined in one tool. You will find both, however, in GTD-AMPCO End Mills.

The precision finish of the shanks, the uniformity of the cutting teeth, the exactness of size assure accuracy in use. Design, steel selection and precisely controlled heat treating give them their ruggedness.

AMPCO TWIST DRILL DIVISION

GREENFIELD TAP and DIE CORPORATION

Greenfield, Massachusetts

FLEXLOC AT WORK

MORE AND MORE FLEXLOC LOCKNUTS are being used on applications where dependable locking is essential to the operation of the equipment and the safety of the operator. This bundling chain with automatic lock provides positive grip and safe, sure bundle handling.

Two FLEXLOC Self-Locking Nuts hold this assembly together. Once the locking threads are fully engaged, the nuts won't work loose, regardless of the conditions under which they are used.

FLEXLOC one-piece, all-metal nuts are available in a full range of sizes in any quantity. Standard FLEXLOCS are stocked by leading industrial distributors everywhere. Write for Bulletin 866 and samples. STANDARD PRESSED STEEL CO., Jenkintown 1, Pa.

DO YOU KNOW? Standard FLEXLOCS smooth off rough bolt threads. The locking threads on all-metal FLEXLOCS are not chewed up when used on rough bolts.

Standard FLEXLOCS lock securely on bolts varying in diameter tolerances. The all-metal, resilient locking sections of the nut accommodate themselves to the diameter tolerances.

Standard FLEXLOCS are one piece, all metal. They are not affected by temperatures to 550°F. Nuts lacking these features have a more restricted temperature range.

Standard FLEXLOCS lock securely—stopped or seated—when 1½ threads of a standard bolt are past the top of the nut.

Standard FLEXLOCS are not affected by moisture, oil, dirt or grit. They lock efficiently under all conditions, regardless of the vibration encountered.

FLEXLOC®
LOCKNUT DIVISION
SPS
JENKINTOWN PENNSYLVANIA

praise from Caesar...

The Salt Lake Tribune, Sunday, June 20, 1954
Here's the New McGee and Hogan
Radial Drilling Machine
With its 5-foot arm, this modern machine is capable of driving a 3" diameter drill to capacity through the center of a 10-foot diameter solid steel work piece. Also used for tapping and large boring operations, it is the only really modern radial of such dimensions in any intermountain machine shop doing repair work.
Veteran operator Pat Langford, above, finds the centralizing of all controls on this machine a big advantage over old-fashioned, scattered control points. Time saved means lower costs per job.
McGEE & HOGAN
MACHINE WORKS
1154 South 2nd West - Salt Lake City - 84-5291

When a customer of such outstanding caliber and recognized reputation as the McGee & Hogan Machine Works of Salt Lake City, Utah spends his own good money to tell the world how good his new "AMERICAN" Hole Wizard Radial is that's really "Praise from Caesar."

The accompanying McGee & Hogan advertisement appeared in the Sunday, June 20th, edition of The Salt Lake Tribune. It shows the new 5' 13" "AMERICAN" Hole Wizard Radial at work in their plant producing work for customers at **"lower costs per job."**

Lots of power, wide range, convenient controls and plenty of ruggedness are doing for McGee & Hogan Machine Works exactly what "AMERICAN" Hole Wizard Radials will do for you.

And Mr. Ray Hogan adds another punch to this testimonial by telling us in a recent letter, "Your machines are doing a wonderful job for us."

Send for bulletin No. 327 and get the facts.

THE AMERICAN TOOL WORKS CO. **Cincinnati, Ohio U.S.A.**

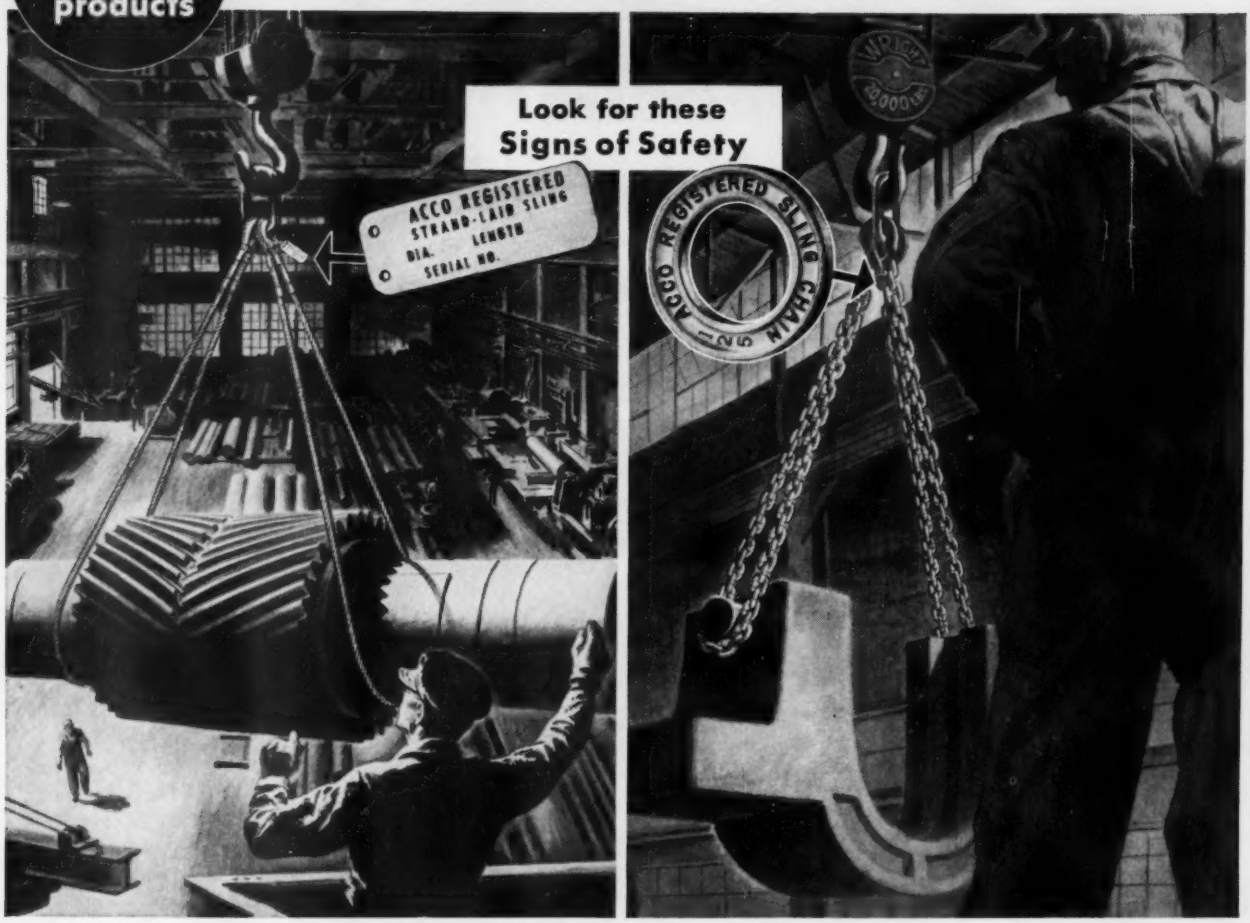
Lathes and Radial Drills

CARD
CARD MFG. CO.
TAPS and
GAGES
by Card
A select line of precision gages is now offered by Card, manufacturer of world-famous Card taps. In every industry, in every shop, these tools speed production, assure you of precision and satisfaction. The new line of gages is equal in every respect to the quality of manufacture that has made Card taps famous over the past 81 years.
Contact your local Card Distributor for prompt deliveries and helpful service.
The CARD Quality
S. W. CARD MANUFACTURING CO.
MANSFIELD • MASSACHUSETTS
Division of Union Twist Drill Co. • TAPS • DIES • SCREW PLATES • GAGES

ACCO products

ACCO Registered* Slings–Wire Rope & Chain

THE STANDARD OF EFFICIENCY AND SAFETY



SAFETY WITH A SAVING

• Materials Handling is one of the most costly production operations, yet insurance of uninterrupted flow of materials is necessary for efficient and economical production. Regardless of how well production is planned, a dropped load can be very costly even without involvement of personal injury. Time is consumed, machining operations already completed can be rendered valueless, and, if a major machine tool is involved, the whole line is shut down.

ACCO *Registered** Slings are materials handling tools specifically designed to require less hook-up time and through their proved safety actually protect *against* production interruptions. All this is money saved and safety gained.

ACCO *Registered* Safety is More Than Skin Deep

Before any item can be used in an ACCO *Registered** Sling it must prove to be the safest, most-efficient available for its particular use. Then it must prove under actual test to have strength equal to, or higher than, that developed by sling body.

For example, the special ACCO Hooks used in these slings are forged, heat-treated to insure standardized strength, proof-tested, inspected, and magnafluxed. NOTHING IS LEFT TO CHANCE.

Components which have passed these tests are then assembled into completed ACCO *Registered** Slings according to designs which have proved their safety and efficiency in rigorous field tests. Next the completed sling is individually proof-tested to twice the working load limit. Then and only then can it be tagged "ACCO *Registered.**"

Compare the assurance given by this careful control of quality, strength, and design with the methods used in fabricating old fashioned, "home-made" slings.

*Trade Mark Registered

ACCO MAKES BOTH CHAIN AND WIRE ROPE SLINGS . . .

ACCO can supply both types of slings. As you know, there are places where one is preferable to the other. And there are places where a combination of both is called for. Whatever the set-up, ACCO Registered slings will fill the bill with greater safety. ACCO can advise you impartially, can furnish dependable printed information.*

Write or phone your ACCO Distributor. If you don't know him, get his name from the ACCO office in city nearest you.

ACCO

TRADE MARK

AMERICAN CHAIN & CABLE

BRIDGEPORT, CONN.

Atlanta, Boston, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Wilkes-Barre, Pa., York, Pa.
In Canada: Dominion Chain Co., Ltd., Niagara Falls, Ont.

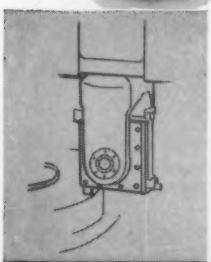
for Better Value

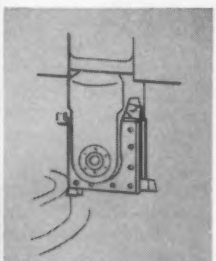
Speed MULTIPLE CUTS

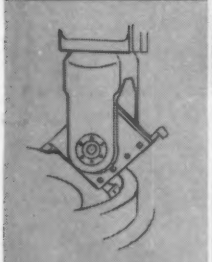
on vertical boring mills with Davis 8-Position *Indexing* Tool Holder

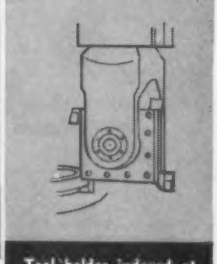
MODEL A
Length 21", weight 105 pounds

MODEL B
Length 24⅝", weight 210 pounds


Holder with facing tool presented to work.


Holder indexed 90° to present turning tool.


Holder indexed at 45° for chamfering.


Tool holder indexed at 90° for undercutting.

PRODUCTIVITY of your vertical boring mill—regardless of make or model—can be profitably increased with this new cost-cutting accessory.

Held in the machine ram head, the Davis Indexing Tool Holder mounts four square-shank cutter bits for successive operations without relocating the work. Also, it presents each tool either square with the work or inclined at a 45° angle, making it useful for a broad range of cuts. Indexing between operations is completed in a matter of seconds, sharply reducing floor-to-floor time. And substantial savings in machining time on multiple operations quickly repay cost of tool holder. Get complete information—learn how your vertical boring mill work can be made more profitable.

PROFIT-BUILDING ADVANTAGES

- ★ Accurately indexes to 8 positions in 45° steps—instant setting.
- ★ Completes 4 operations without changing tools or relocating work.
- ★ Supplied for right or left-hand ram heads of any vertical boring mill.
- ★ Bores, turns, faces, chamfers, and undercuts.

DAVIS
BORING TOOL DIVISION OF
Giddings & Lewis Machine Tool Company
Fond du Lac, Wisconsin

THE ONE NAME THAT CERTIFIES ULTIMATE PRECISION AND PRODUCTIVITY IN TOOLING

these thread rolling production pictures* would look good in any shop! now look even better!

Report from Plant #1
"This shop has been rolling 3/8"-16 threads continuously for two months—at 2000 rpm. Still on first set of rolls. 350,000 pieces to date."

Report from Plant #2
"Have three machines rolling 7/16"-20 threads on C-1114 steel studs—'Close to a million' so far—and rolls have not been turned around.*"

(*Thread Rolls are reversible, having a lead of 1½ to 1¾ threads on both sides.)

*Take a look at two recent National Acme sales reports. More information on request.

These two reports show that National Acme (Fette Patent) SELF-OPENING Thread Rolling Heads come mighty close to being the answer to a production engineer's prayer for a steady, day-in, day-out flow of threaded pieces into the pan.

And when you consider that these thread rolling heads give you better threads—with smoother, more wear resistant surfaces, and with no cratering at the crest—aren't you missing a bet if you don't put them to the test on your threading jobs?

Wherever the work calls for threading machined parts from the end, there's no faster, better way than to "roll-em-on" with a National Acme (Fette) self opening head.

We'll be glad (and we think you will be too) if you ask us to prove that statement. Send sample or blueprint for our recommendation—or ask our representative to call.

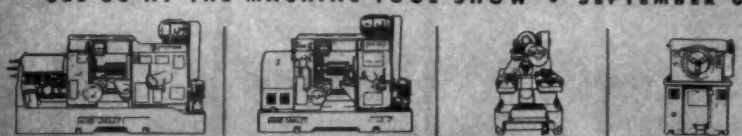
May we send you a copy of Catalog FRH-58A ?

National Acme (Fette) Thread Rolling Heads are used on automatics, turret or hand lathes, threading machines, drill presses, and other types of vertical or horizontal machines. Basically, they are SELF-OPENING heads which operate like a die head, except that threading rolls are used instead of chasers. And they OPERATE AT HIGH-SPEED-STEEL TURNING TOOL SPEEDS. Made in Revolving Type (capacities 7/16" to 1") and in Non-revolving Type (capacities 1/16" to 3/4").

THE NATIONAL ACME COMPANY
170 EAST 131st STREET • CLEVELAND 8, OHIO.

RIGHT ON SCHEDULE! 4 months and another 1,000,000 pieces later, the original set of rolls are still on the job. Have you taken a close look at your threading picture lately?

SEE US AT THE MACHINE TOOL SHOW • SEPTEMBER 6 TO 17 • BOOTH NUMBERS 324 AND 705



OUR JOB: to provide the *Right Machine* for YOUR JOB

Acme-Gridley 4, 6 and 8 Spindle Automatic Bar and Chucking Machines • Fully Automatic Turret Lathes (Bar and Chuck Type) • Hydraulic Thread Rolling Machines • Automatic Threading Tools • Switches • Solenoids • Contract Manufacturing.

THE NATIONAL ACME COMPANY
171 EAST 131st STREET • CLEVELAND 8, OHIO

Hendey NO. 2E LATHE WITH ELECTRONIC

simplifies lathe operation . .

OPERATOR EFFORT IS REDUCED TO A MINIMUM
MACHINING EFFICIENCY IS INCREASED
16-7/16" SWING OVER WAYS
COSTS ARE CUT AT EVERY TURN

Hendey electronic control of spindle speeds on No. 2E Precision Lathes is effortless with this convenient fingertip selector. It affords a quieter, more efficient drive, with closer control over speeds than is possible with other types, especially at the slower rates. Speeds are adjusted smoothly, either pre-set or while cutting, through the full range up to 1500 r.p.m. to give the most efficient cutting rate for the particular type of cut. Operating efficiency is further stepped-up by single-lever control of start, stop and reverse. Dynamic braking allows smooth and rapid changing from forward to reverse rotation of the spindle.

Additional Hendey quality features make this general purpose lathe a machine you should see before you buy any lathe . . . especially if you want maximum operating efficiency, work accuracy and reduced cost on turning operations.

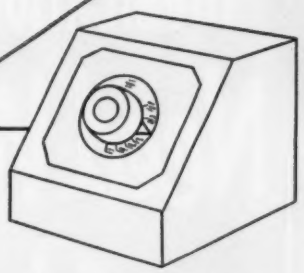
See It In Action! Booth No. 221

TOPS IN ACCURACY . . . HENDEY PRECISION-BUILT

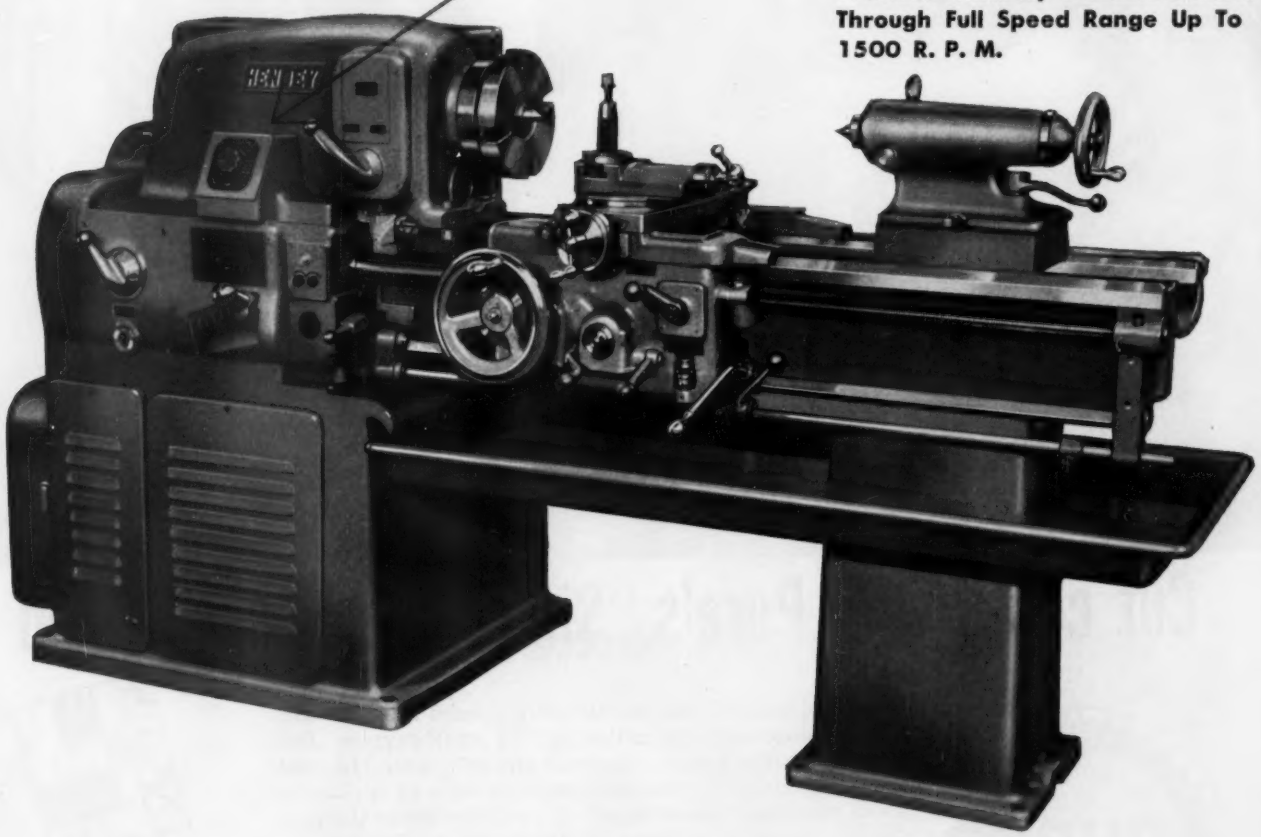
• Automatic Threading Tools • Switches • Solenoids • Contract Manufacturing.

SPEED SELECTOR

. cuts production time



Instantaneous Speed Selection . . .
. . . Pre-Set or While Cutting . . .
Provides Infinitely Variable Control Through Full Speed Range Up To 1500 R. P. M.



MACHINE TOOLS *Hendey* **machine division**
BARBER-COLMAN COMPANY
211 LOOMIS ST., ROCKFORD, ILLINOIS

BARBER COLMAN

Cut costs with Pure's "Simplify and Save" plan

THE PURE OIL PURE COMPANY, U.S.A.

Pure Oil research has developed a special line of multi-purpose lubricants for industry. Why *multi-purpose* lubricants? It's this simple: the fewer the lubricants, the lower your inventory . . . the less chance for error in application (and resulting "down time") . . . and the fewer the man-hours needed for ordering, stocking and application.

Experience proves that, in the average plant, a maximum of six Pure Multi-Purpose lubricants is all you need. Let Pure Oil's industrial engineers show you how to streamline *your* lubrication program. Reverse the charges to your nearest Pure Oil office. Call now.

FREE BOOKLET tells you "How to Simplify and Save." Write The Pure Oil Company, 35 E. Wacker Drive, Chicago 1, Illinois. (Offer limited to Pure Oil's 24-state marketing area.)

Be sure with Pure **PURE MULTI-PURPOSE LUBRICANTS**

Sales offices located in more than 500 cities in Pure's marketing area

...corner high production

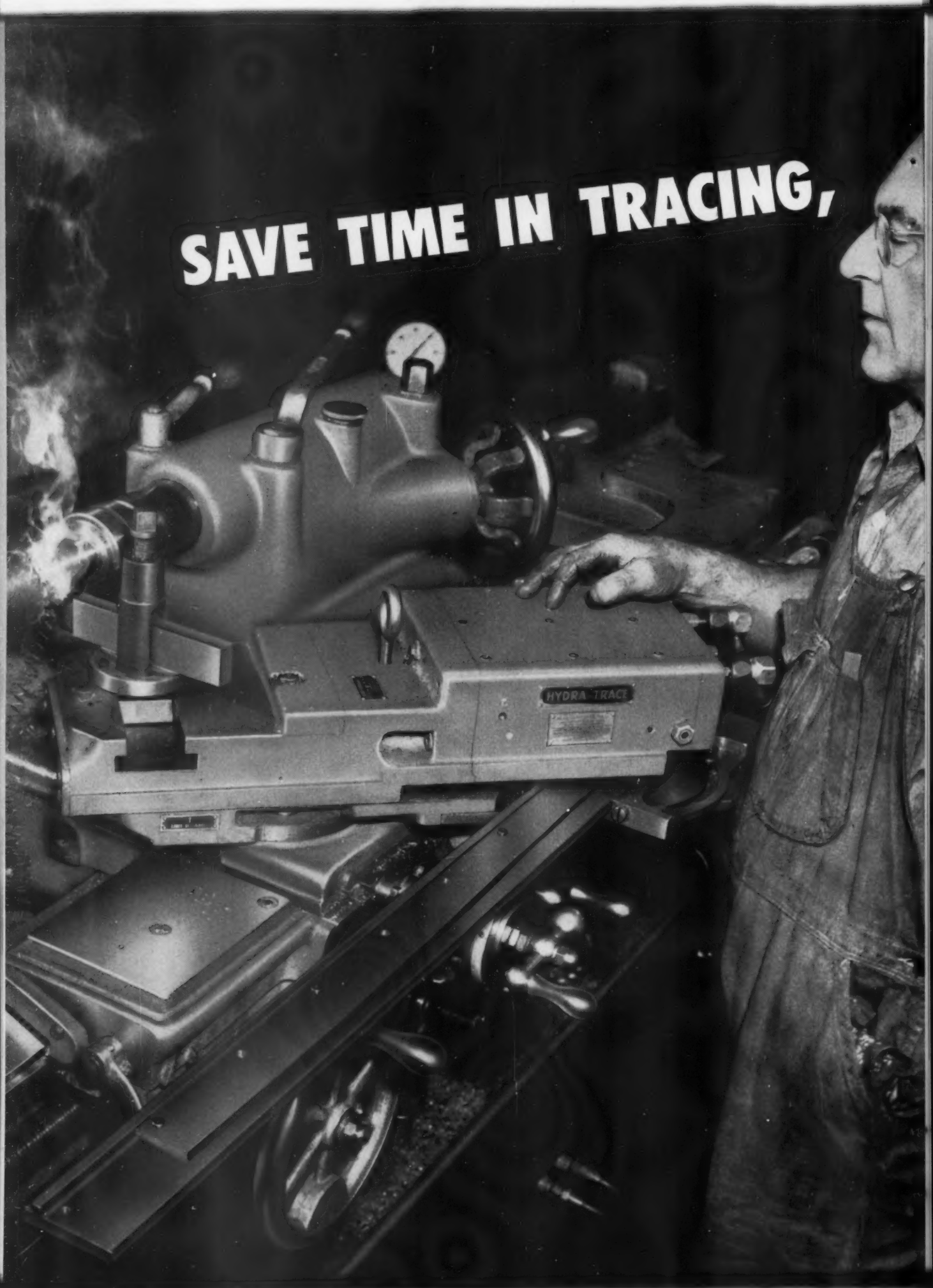
SEE YOUR

Threadwell

DISTRIBUTOR

FOR THE FINEST IN
CUTTING TOOLS AND GAGES

Made by THREADWELL, Greenfield, Mass.


SAVE TIME IN TRACING,
HYDRA-TRACE

TURNING, FACING

with **Hydra-Trace*** *and your LeBlond lathe!*

Check the job list of most any LeBlond Lathe—Hydra-Trace combination. You'll find it turning complex dies in the morning, step shafts in the afternoon. Yesterday, it was contour facing compressor discs; tomorrow, turning bevel gear blanks. And saving time on every one!

Hydra-Trace can be mounted in place of the compound rest on most any LeBlond Lathe . . . *in minutes*. It swivels to the most favorable angle for proper tool clearance. Its flat template is easily made, conveniently stored. Template holder and all controls are neatly located at front of lathe. And you can remove Hydra-Trace to use your lathe for other work in practically no time at all!

For complete data on Hydra-Trace, ask for Bulletin HT-2A

American Brass saves 91% of a 6-hour job! Turning mandrels shaped like baseball bats (used in drawing seamless tubing) ate up 6 hours of lathe and operator time at The American Brass Co., Waterbury, Conn. With Hydra-Trace installed on their LeBlond 16″ x 78″ HD lathe, it's done in 30 minutes! And the same lathe, with Hydra-Trace removed, is still available for regular turning, facing and chasing!

If variety is important in your lathe operations, you can't do better than Hydra-Trace and a LeBlond lathe. We'll tell you promptly whether Hydra-Trace will fit the LeBlond you have. Or we can recommend *exactly* the right combination for your requirements from scores of lathe sizes and models. See your LeBlond Distributor or write Cincinnati today.

THE R. K. LEBLOND MACHINE TOOL CO., CINCINNATI 8, OHIO

*Hydra-Trace (Trade Mark registered U. S. Pat. Off.) is LeBlond's heavy-duty hydraulic tracing attachment. Can be mounted in place of compound rest on practically all LeBlond lathes built since 1935.

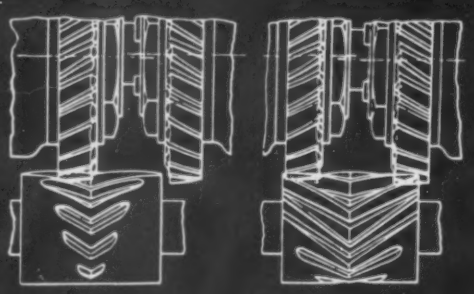
. . . cut with confidence

Be sure to see LeBlond, Booth 1313

LEBLOND *of Cincinnati*

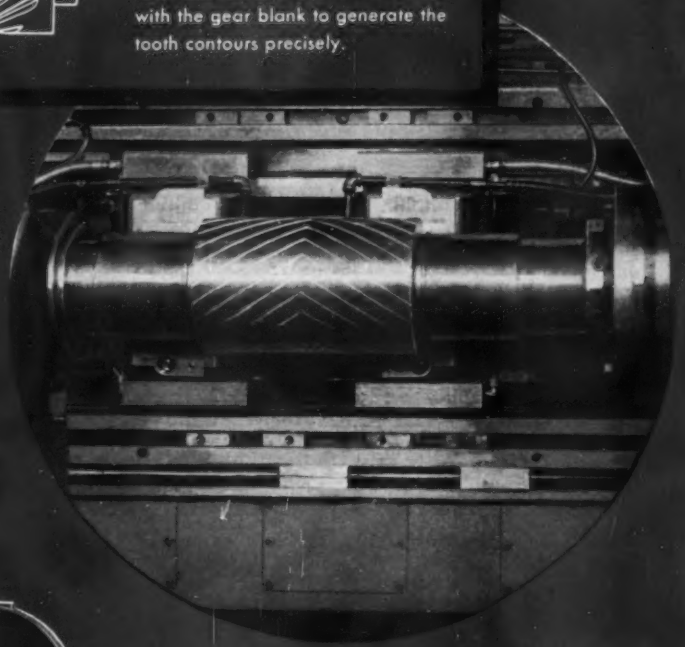
World's Largest Builder of a Complete Line of Lathes • For More than 68 Years

TAKE A LOOK AT FARREL-SYKES ACCURACY



PRECISION GENERATION

The cutters of Farrel-Sykes machines reciprocate, one cutting when movement is in one direction and the other when the movement is reversed. Each ends its stroke at the center of the blank. As they cut, they rotate to generate the helices and also slowly revolve in unison with the gear blank to generate the tooth contours precisely.



Start of cutting operation on a continuous tooth herringbone pinion with integral shaft.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Cambridge (Mass.), Akron, Cleveland, Chicago, Los Angeles, Houston

Farrel-Birmingham ®

The accuracy inherent in the operating principle of the Farrel-Sykes gear machine—*precision generation*—gives gears precise tooth spacing, profile and helix angle.

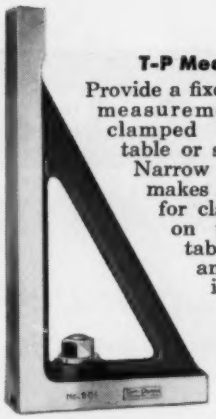
Besides precision, the "twin-head" generator gives you versatility, high production and convenient operation. It makes fast, simple work of cutting every type of herringbone gear, single helical and spur gears, two members of a cluster gear simultaneously, and other toothed and cylindrical forms.

Write now for details of this accurate and versatile gear generator.

FB-950

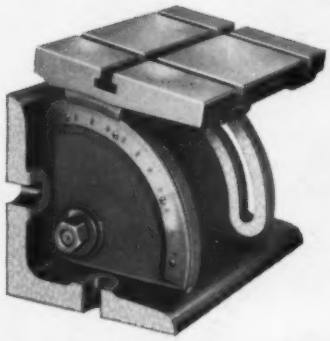
T-P Angle Irons Cut Setup Time

More Cost-Cutting Tips From Taft-Peirce



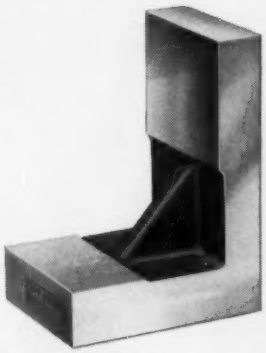
T-P Measuring Irons

Provide a fixed surface for measurements when clamped to machine table or surface plate. Narrow width also makes it convenient for clamping work on the machine table. Front face and bottom finished square within .0002″ per foot.



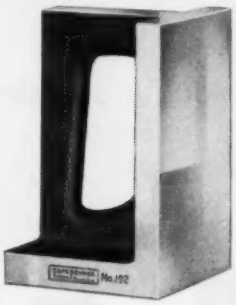
T-P Toolmaker's Adjustable Knee

Table tilts and firmly clamps at angles from 0° to 90°. Graduated quadrant and vernier reads within 5 minutes of angle. Special sine bar feature permits setting within 30 seconds of angle. Surfaces on base right angle are finished scraped.



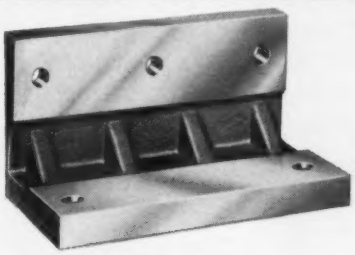
T-P Toolmaker's Knee

Useful for mounting small work. Pads are finished on back of each angle for clamping purposes. Sides and faces are square within .0001″. Finest quality close-grained cast iron, heat treated and ground.



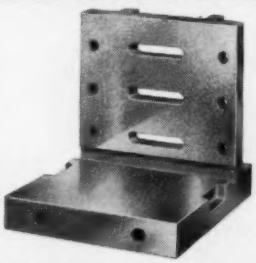
T-P Universal Right Angle Irons

Invaluable wherever an accurately square reference surface is desired. Use as height block or clamp work to one face, and place block in any number of positions to make measurements without relocating. Square and parallel within .0002″ or .0003″.



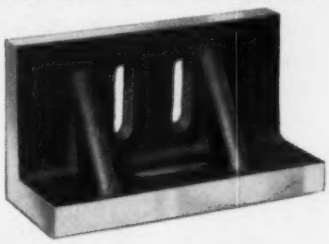
T-P Duplex Angle Irons

Speeds setups on planers, boring mills, shapers, drill presses. In many cases, eliminates need for table clamping. Finished inner pads parallel to sides within .0005″. Outer faces ground square within .0005″ in 6″.



T-P Multiplex Angle Irons

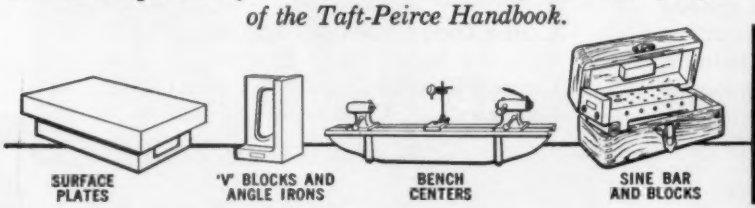
Eliminate multiple setups and excessive handling. All surfaces are scraped square within .0005″ in 6″ . . . parallel within .0005″. Holes and slots for clamp bolts. 4 tapped holes for eye bolts. Recessed lips in base section for clamping.



T-P Slotted Angle Irons

Working faces are ground square within .0005″ in 6″. Holes and slots for clamping bolts. Finest quality close-grained cast iron, heat treated and seasoned. Stocked in a number of sizes. Hand scraped or specials on request.

For the complete story on these items and many more send for your copy of the Taft-Peirce Handbook.



T-P means Top Precision

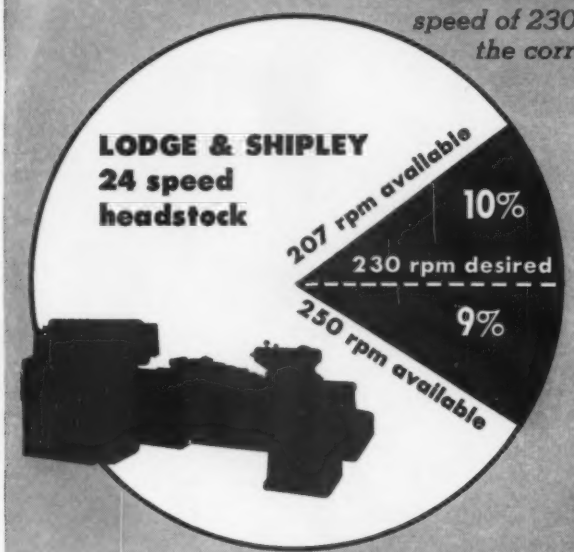
T P

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

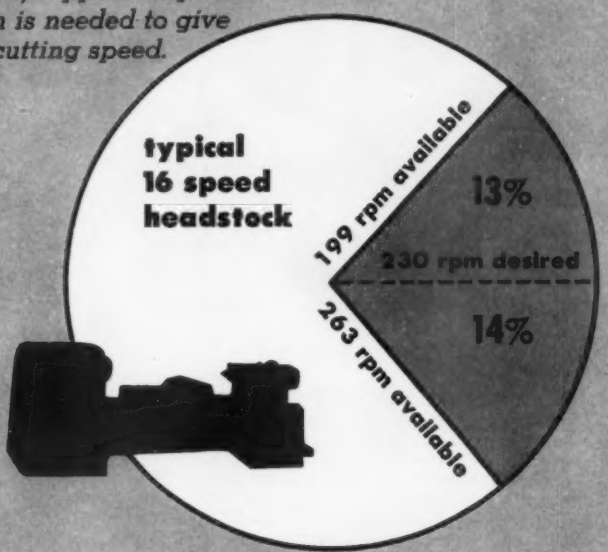
GET MORE PRECISE SELECTION of RIGHT CUTTING SPEEDS

with LODGE & SHIPLEY 24 SPEED HEADSTOCKS due to smaller speed increments over a wider range.

To illustrate our point, suppose a spindle speed of 230 rpm is needed to give the correct cutting speed.



On the Lodge & Shipley 16-inch, 24-speed Headstock, 207 and 250 rpm are available. Choosing 250 rpm gives a speed that's within 9% of the desired speed.



On a typical 16-inch, 16-speed Headstock, 199 and 263 rpm are available. Choosing 199 rpm gives a speed that's within 13% of the desired speed.

On these same lathes The Lodge & Shipley 24-speed Headstock also has a wider range—14 to 1160 rpm . . . compared to the typical 16-speed headstock's 16 to 697 rpm range.

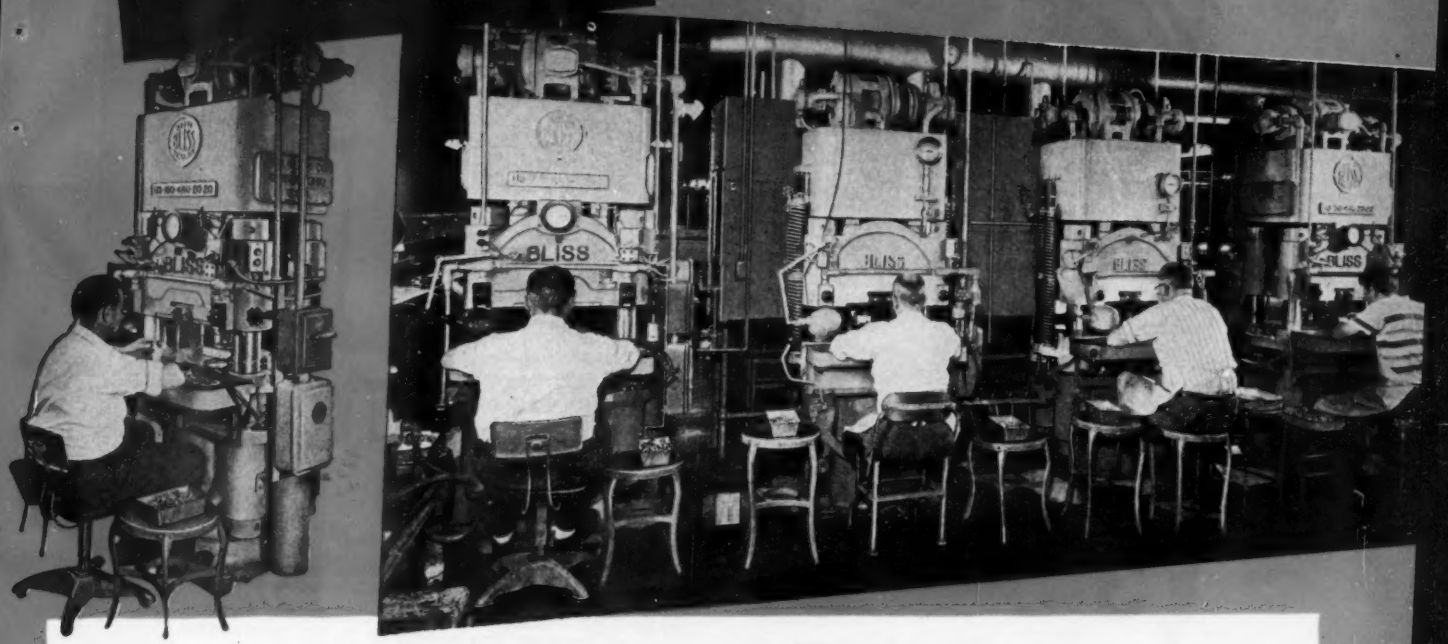
Considering a new lathe? You'll find it well worth investigating the number of spindle speeds, the size of the speed increments and the range. The more speeds you have (up to a practical limit) and the smaller the increments between speeds . . . the more perfect choice of cutting speeds you can make. Insufficient spindle speeds severely limit your selection as indicated in the data above.

Lodge & Shipley Model X Lathes give you 24 speeds . . . up to 50% more than some comparable lathes. That's a 50% better chance to select the correct speed and obtain truly economical production.

Call a Lodge & Shipley representative or write for literature on this subject. The Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

Lodge & Shipley *....your* LODGE-*ical choice!*

For HYDRAULIC presses, too . . .
it pays to specify BLISS



Gruen obtains MICRO-PRECISION accuracy with

BLISS HYDRO-DYNAMIC PRESSES

Accuracy is the keynote of operations at the Gruen National Watch Case Company, Cincinnati, Ohio. This is especially true in the forming of the case itself. Here, tolerances are critical—with an exact fit of the crystal inside the watch case essential to keep it from falling out. Gruen prefers the Bliss Hydro-Dynamic presses for this job—holding tolerances to several ten-thousandths of an inch.

Equipped with high- and low-pressure pumps, these Bliss Hydro-Dynamic presses are the moving-up type . . . especially suited to industries employing sub-die processes. Their efficient, accurate operation is typical of results obtained with Bliss Hydro-Dynamic presses in all types of plants. At Gruen, *72% of the presses are Bliss-built.*

Let Bliss, the world's largest press builder, apply its long experience to *your* next press problem. Talk it over with a Bliss sales engineer. He can help you select the right press for your special requirements. Meanwhile, for more detailed information about Bliss Hydro-Dynamic presses, write for Catalog 30-A.

BLISS on your press is more than a name . . . it's a *guarantee*

E. W. BLISS COMPANY, Canton, Ohio

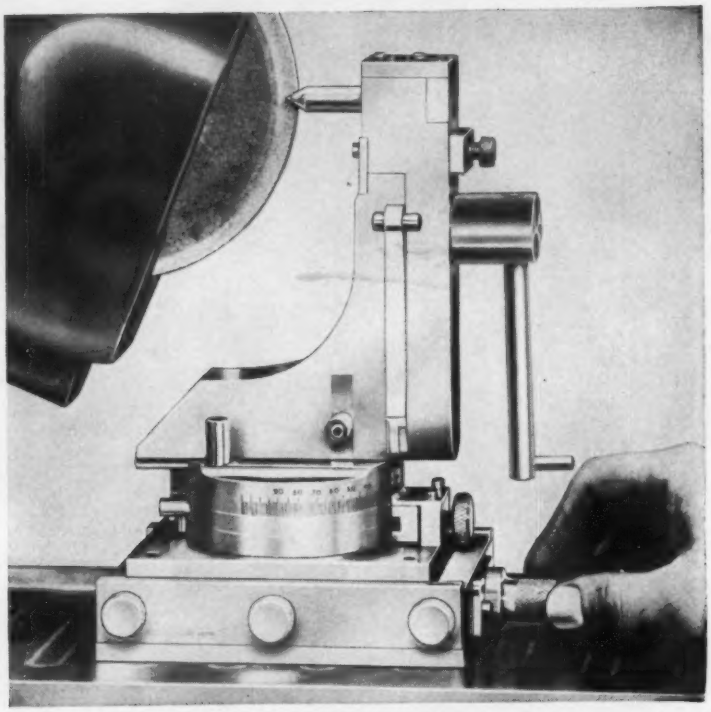
PRESSES, ROLLING MILLS, SPECIAL MACHINERY

U. S. Plants in Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; San Jose, California. *Branch Offices* in Buffalo, Chicago, Cleveland, Dayton, Detroit, Indianapolis, Los Angeles (Burbank), New Haven, New York, Philadelphia, Rochester, San Jose, Toledo, Washington, D.C.; and Toronto, Canada. Other representatives throughout the world.

E. W. Bliss (England) Ltd., Derby

E. W. Bliss Co. (Paris), France

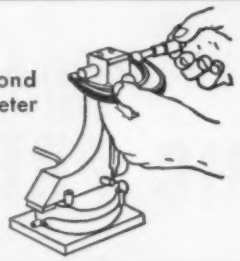
EASY AS--- 1, 2, 3



READILY ADAPTABLE TO INTERNAL, CYLINDRICAL AND SURFACE GRINDER USE FOR WHEELS UP TO 24" IN DIAMETER.

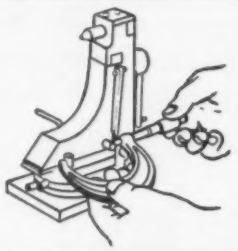
Measure over diamond point to back of micrometer plate.

1



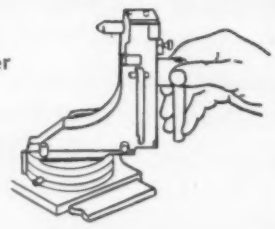
Add required convex radius or *Subtract* required concave radius.

2



Tighten gib. Dresser ready for action.

3



The J & S "Fluidmotion" Wheel Dresser can be set in seconds to dress any angle. Complex concavities or convex shapes can be set in a few minutes.

Fully adjustable with swivel base and patented "Fluidmotion", there is no other method that gives you the "precision flexibility" and ease of dressing simple or complicated shapes and contours.

By equipping your shops with a sufficient number of J & S Dressers, job hold-ups and waiting time can be eliminated, thereby keeping your men and machines producing.

Write for fully illustrated literature that shows in detail the wide adaptability of the "Fluidmotion" Dresser for just about any wheel dressing job. It comes in several sizes that will dress wheels ranging from the smallest up to 24 inch diameter.

J&S TOOL CO., INC.

WHEEL DRESSERS • JAW CLAMPS • PRECISION VISES • SINE BARS • DOWN-HOLDING DEVICES

REPRESENTATIVES IN PRINCIPAL CITIES

J & S TOOL CO., INC.

646 WEST MT. PLEASANT AVENUE, LIVINGSTON, NEW JERSEY

ALL AT SEA?

. . . about machine tool replacement . . . the cost and profit factors involved . . . how best to finance the new equipment you need?

In other words . . .

Is there such a thing as...

A PRACTICAL REPLACEMENT PROGRAM?

YES! — and Jones & Lamson can help you develop it

Industry unanimously endorses the idea of planned replacement of capital equipment. Nevertheless, most of America's machine tools are more than 10 years old, sadly inferior to today's profit-producing equipment. The idea is sound — but action is lacking.

Biggest reason for this paradox is financial. Until recently, replacement required a substantial outlay of capital. In many cases, needed capital was lacking; in others, the capital, though available, had many other calls upon it. Unrealistically low depreciation allowances on capital equipment served as an added deterrent to replacement.

The picture has changed. Now, provisions of our new tax laws permit more equitable write-offs, and make replacement a more attractive proposition.

Jones & Lamson makes replacement even *more* feasible, by clearing away the traditional difficulties of financing with its unique Procurement Plans.

This, then, is what Jones & Lamson offers: modern machine tools that can greatly improve your production; *plus* your choice of several sound, low-cost (interest rates of 3¼%, and lower, add-on) methods of procuring these tools.

OBSOLETE machine tools like these hamper industrial growth, keep production low, and costs high.

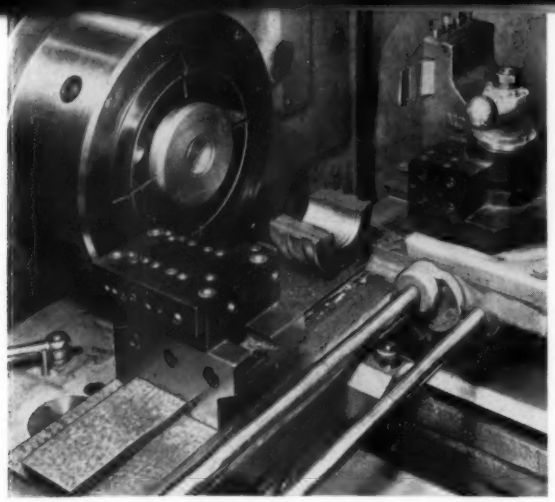
RESEARCH in machining methods, metallurgy, tool geometry, is carried on continually by J & L. Important findings have resulted in the incorporation of unique engineering features in J & L machines.

Measu
point to
plate.

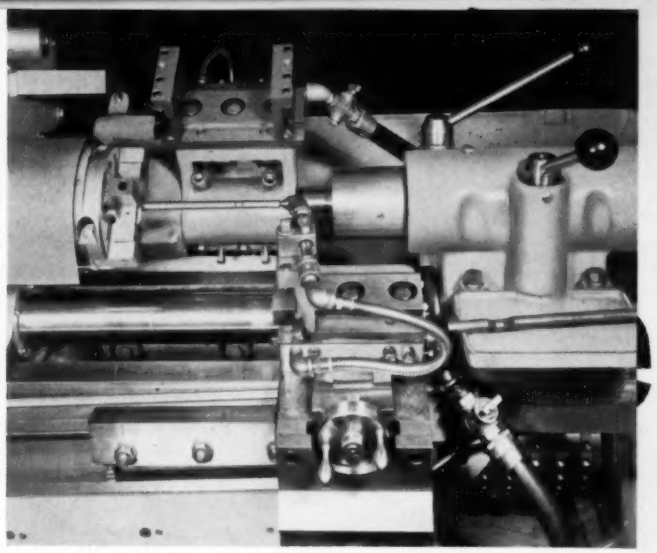
Add re
radius
quired

Tighten
ready

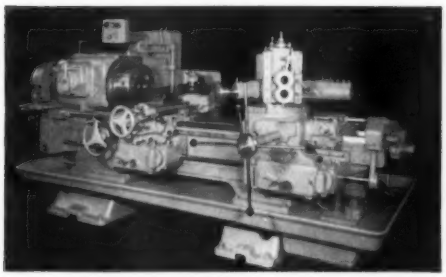
J
TOO



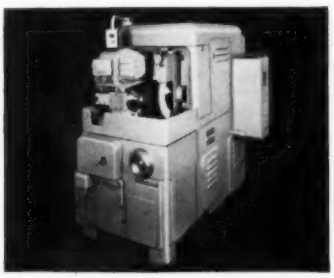
IMPROVED production on this difficult machining job was made possible by J & L engineers' close co-operation with the customer. Research testing, and incorporation of special features on a J & L turret lathe cut time-per-piece on this bottle neck-ring from 14 to 5½ min., increased production 120%!



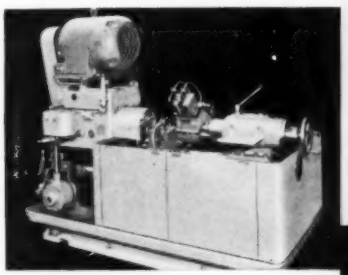
AUTOMATIC OPERATION. One Fay Automatic Lathe replaced eight engine lathes formerly used on this job — and substantially increased production of sewing machine crankshafts at the same time.



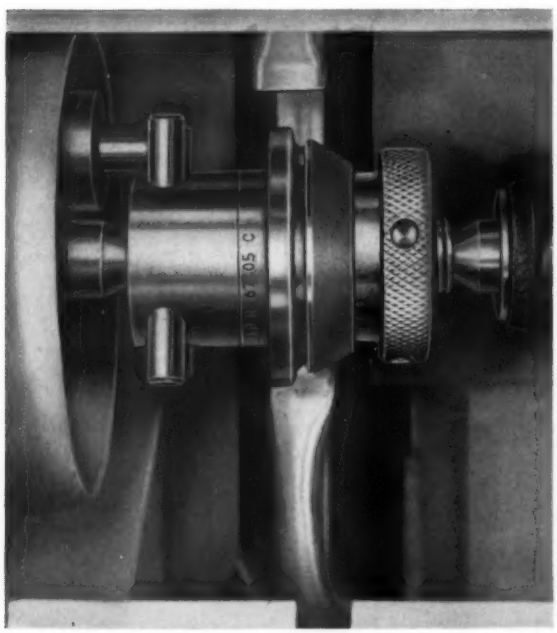
Universal Turret Lathes



Automatic Thread & Form Grinders



Fay Automatic Lathes



GRINDING. This J & L Model "E" Form Grinder, used in producing seaming rolls for the canning industry, completely eliminated a roughing operation, increased production by 100%.

JONES & LAMSON MACHINE COMPANY

502 Clinton St., Springfield, Vt., U. S. A.

Universal Turret Lathes • Fay Automatic Lathes • Automatic Thread & Form Grinders
Optical Comparators • Automatic Opening Threading Dies & Chasers
Automatic Double-End Milling & Centering Machines

Send today for complete details on J & L's machines, methods and Procurement Plans. Simply fill in the coupon below, clip it to your letterhead and mail. We'll do the rest.

JONES & LAMSON MACHINE COMPANY
502 Clinton St., Springfield, Vt., U. S. A.

GENTLEMEN: Please send me the J & L Machine Tool Replacement Information Kit.

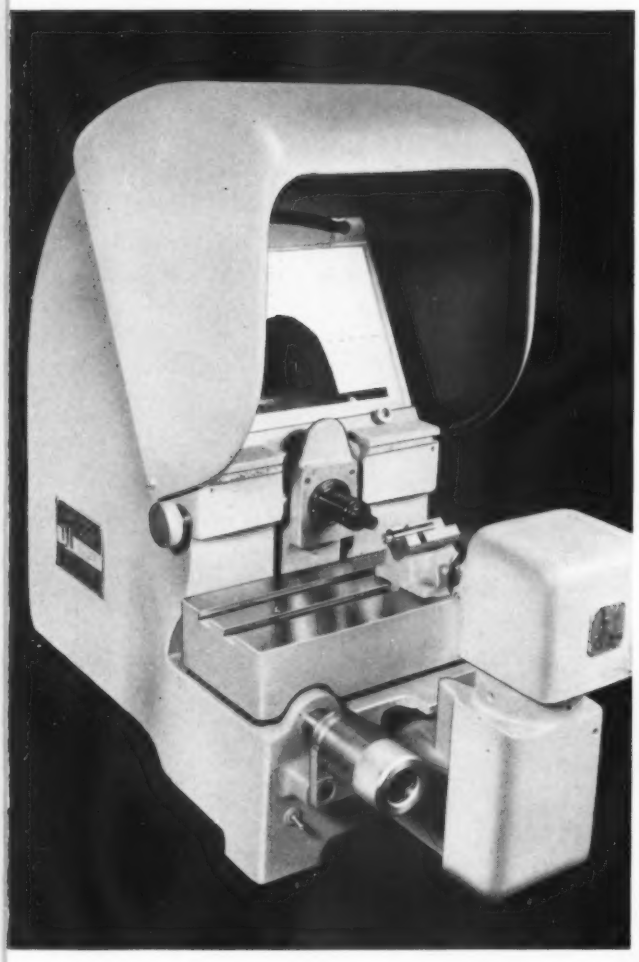
Name.....

Title.....

ACCURATE PRODUCTION INSPECTION AT LOW COST

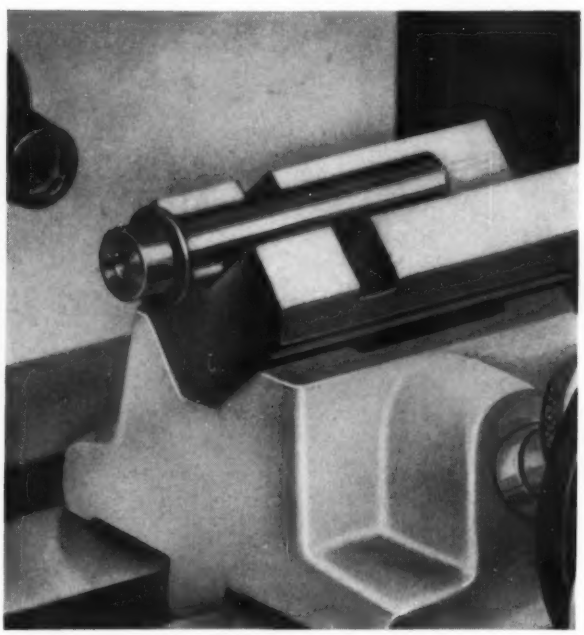
The Jones & Lamson BC-7 Optical Comparator

A versatile... economical... easy-to-operate bench gage



The inspection of "O" rings is a good example of the difficult jobs that are easily handled by the J & L BC-7 optical comparator. The rubber rings are held on a simple plug gage which duplicates their positioning in final assembly. The operator then merely looks at the chart on the viewing screen to check for thickness and amount of flash. The chart is a standard grid, laid out in .050″ squares which represent .001″ on the "O" ring at 50 magnifications.

There is *no* danger of distorting the piece as there would be in mechanical gaging. Only this one gage is used, because the optical comparator inspects in *all* planes.



By merely changing the fixture and chart, a great variety of totally different parts can be inspected accurately and economically.

World's largest manufacturer of Optical Comparators since 1919

JONES & LAMSON MACHINE COMPANY

COMPARATOR DIVISION, 502 Clinton St., Springfield, Vermont, U. S. A.

Title .....

Here Is Extra Motor Value

Double-shielded bearing
Large grease reservoirs
Bolted-on bearing cap
Labyrinth seals

This Allis-Chalmers Bearing Design Gives More for Your Motor Dollar

You can lubricate these bearings without dismantling motor. Pipe-tapped holes in the bearing housings at two points provide means for inserting new grease, flushing out old grease and relieving pressure during re-greasing.

The bearing cap is held tightly in place against the inner face of the bearing enclosure. This cap, with its close running clearances, keeps grease from the interior of the motor . . . retains an ample supply within the bearing enclosure . . . protects the grease and the bearing against contamination from dirt and moisture.

At the outer side of the bearing, double labyrinth seals keep grease in, also keep dirt out. What's more, large grease reservoirs act as additional dirt traps.

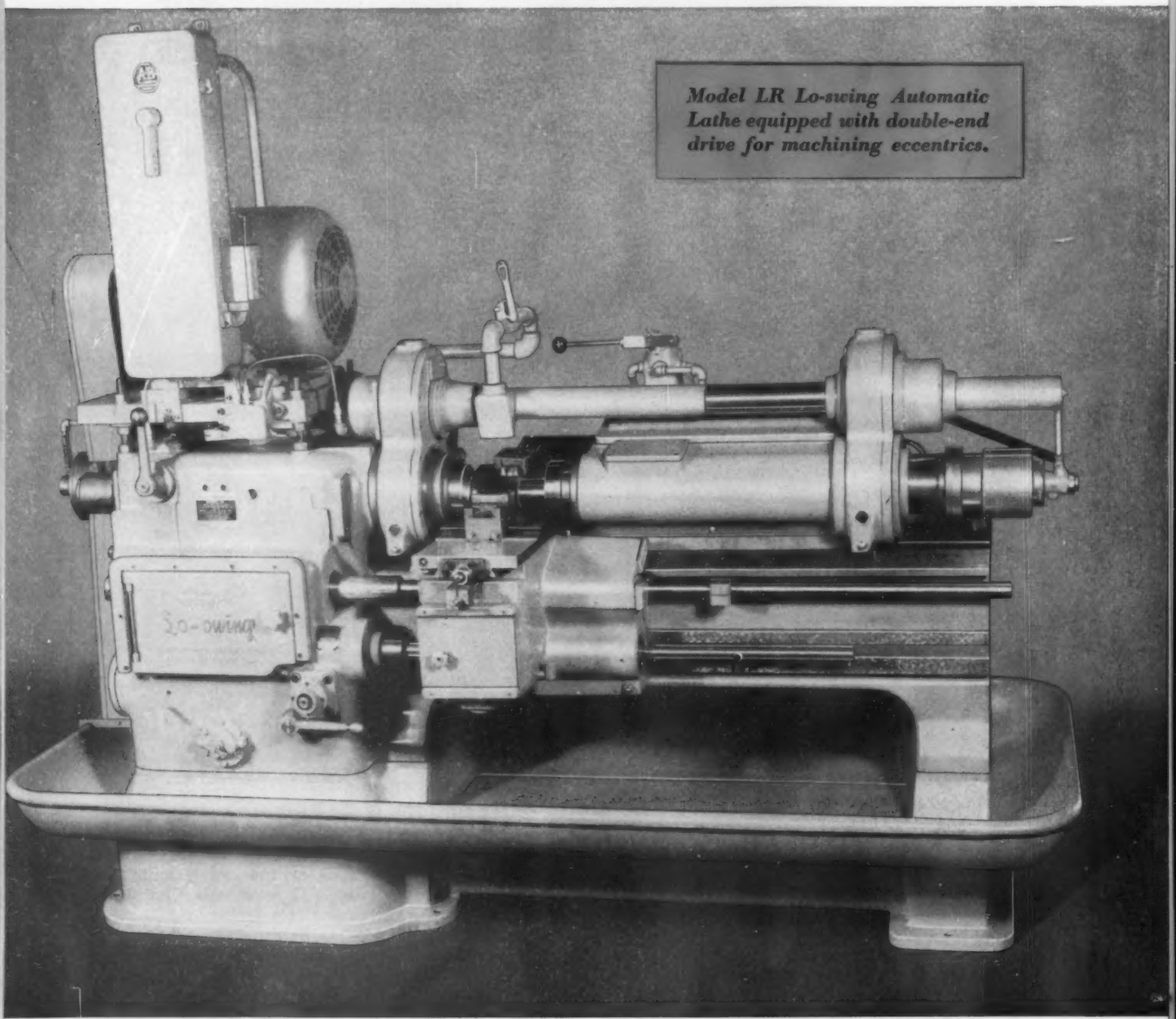
Look for the extra bolts on the end housing . . . the sign of greater value. Ask your Allis-Chalmers representative or Authorized Distributor to show you a cutaway section of this maintenance-cutting design. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 51B6210.

A-4617

ALLIS-CHALMERS

MACHINE OF

DOUBLE END DRIVE *Lo-swing* LATHE MACHINES ECCENTRICS AT A FAST PACE

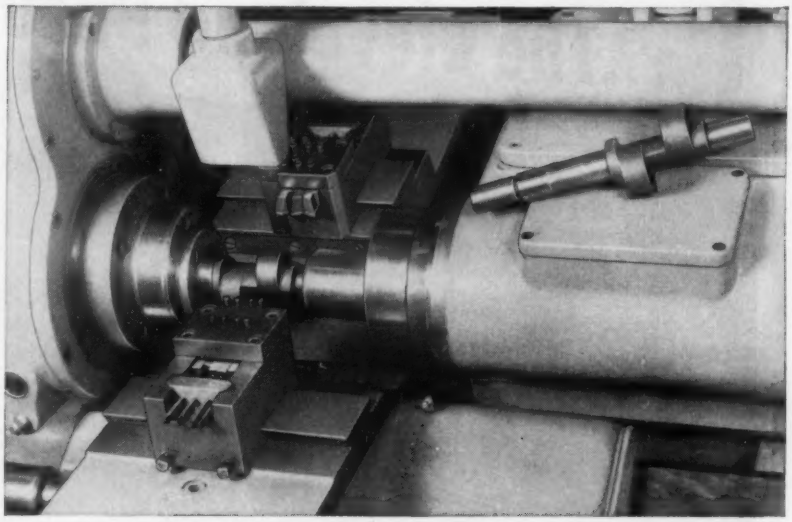


Model LR Lo-swing Automatic Lathe equipped with double-end drive for machining eccentrics.

PRODUCTION COSTS

THE MONTH

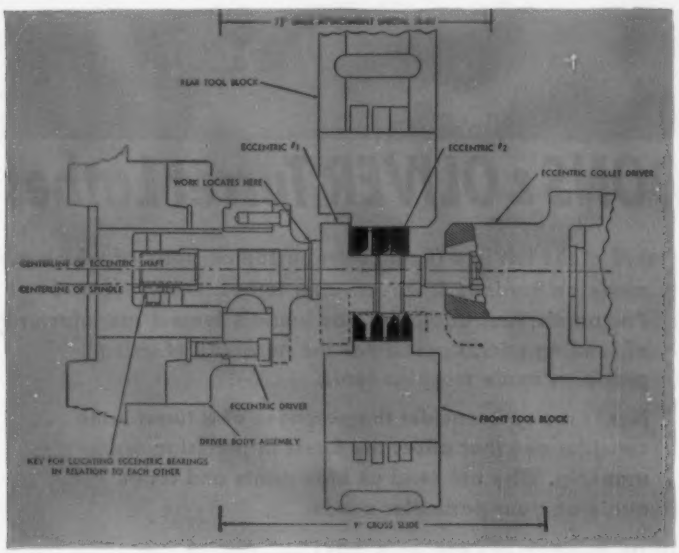
PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK



PROBLEM: To accurately machine eccentric bearings on compressor shafts within close tolerances.

SOLUTION: The Model LR Automatic Lo-swing Lathe selected for this operation was equipped with a double-end drive to prevent twisting or distortion of the shaft due to tool cutting pressures. The drive to the tailstock is taken from the headstock spindle and transmitted to the tailstock spindle by means of an overhead drive shaft. Special gearing eliminates all backlash.

The work is held and driven with offset drivers mounted on both the headstock and tailstock spindle noses as shown in the line drawing. The drive from the headstock end is through a key which positions the shaft in relation to either No. 1 or No. 2 eccentrics. The drive from the tailstock spindle is by means of an air-operated collet driver. Loading and unloading of parts is facilitated by an air-operated tailstock which retracts 6-1/2" by a simple movement of an air control valve.

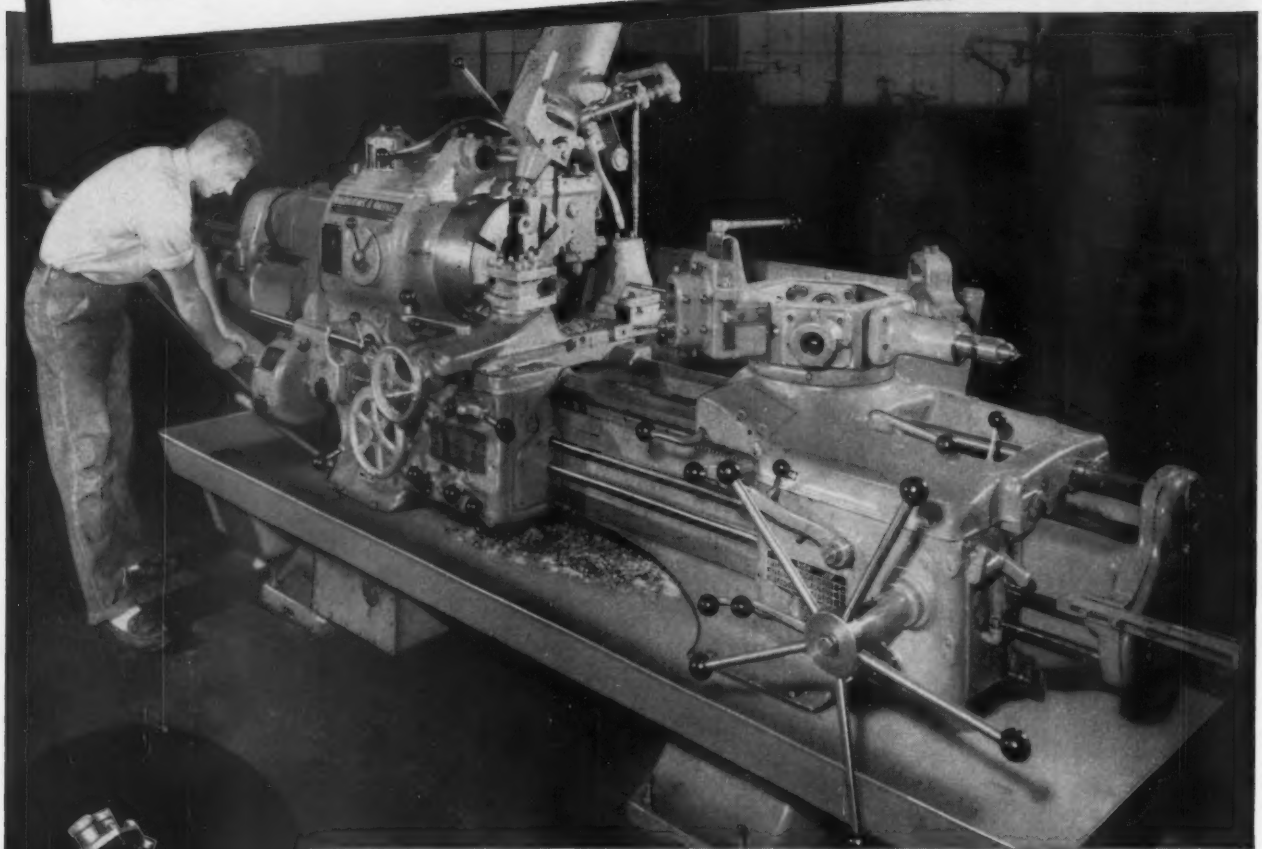


The tooling used for this job is shown on both the line drawing and the close-up view of the operating area of the machine. The front tool block has four tools for turning the eccentric and the clearance diameters adjacent to the eccentric. The back squaring attachment carries three tools, one for facing the side of No. 1 eccentric and the other two for chamfering the edges of No. 2 eccentric.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

ARE LOWER WITH Lo-swing

Holding AIRCRAFT TOLERANCES at ...The Cleveland Pneumatic Tool Co.



...on BARDONS & OLIVER Turret Lathes

Photographs courtesy of The Cleveland Pneumatic Tool Company

Illustrated at the left is a flight control actuator, parts of which are made on Bardons & Oliver turret lathes. The Cleveland Pneumatic Tool Company, the world's largest manufacturer of landing gear, appreciates the necessity of using precision made machine tools.

Next time *you* consider the purchase of a turret lathe . . . consider one that offers the finest in precision workmanship. Why not send us blue prints and let us quote on your particular needs.

MANUFACTURERS OF A COMPLETE LINE OF TURRET LATHES AND CUTTING OFF LATHES

BARDONS & OLIVER, INC.

1134 WEST 9TH STREET • CLEVELAND 13, OHIO

Universal collapsing tap parts of **MAX-EL** alloy steel finish machined after full heat treatment

Considerable machining is required in the manufacture of parts for these taps. That's why Crucible MAX-EL® 3½ free machining alloy steel was chosen by the Geometric Tool Company, Division of Greenfield Tap and Die Corporation. For with MAX-EL you can rough machine, *then* heat treat even intricate parts before final machining *with no danger of distortion of the steel.*

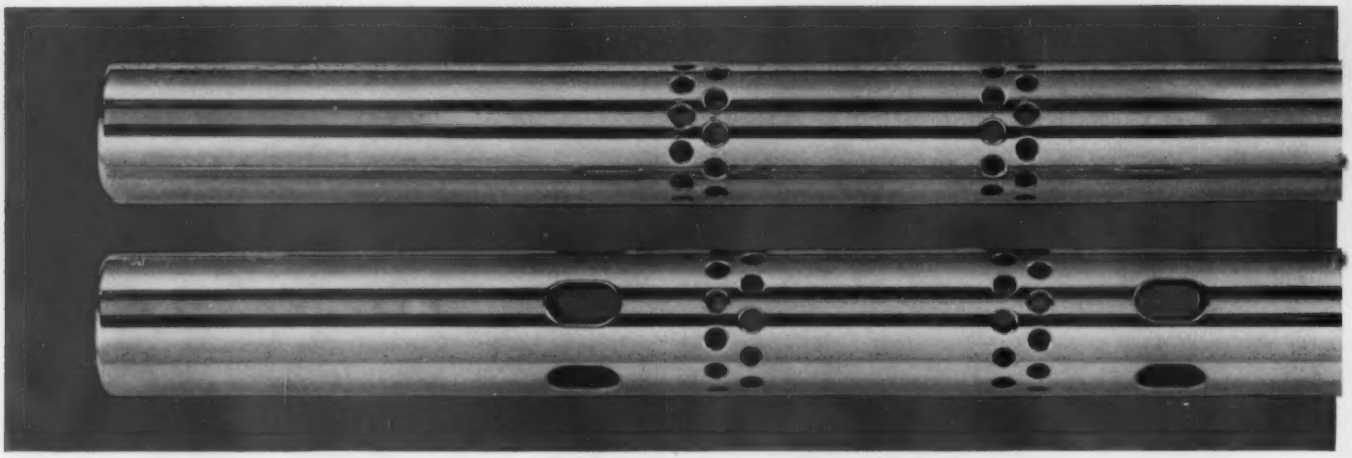
But the best way to check the advantages of MAX-EL is to try it in your own shop. Like many other users you'll appreciate its superior machinability, freedom from distortion, deep hardenability characteristics, uniformity and quality. And you'll like the longer tool life you get by using MAX-EL.

For complete data . . . and *quick delivery* of MAX-EL alloy steels *call Crucible.*

CRUCIBLE first name in special purpose steels

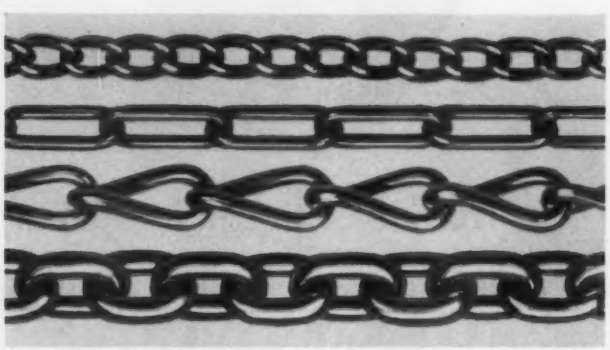
54 *years of* Fine *steelmaking* **ALLOY STEELS**

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.



Free-machining ENDURO®

MACHINING COSTS WERE REDUCED on these automobile door hinges when they were made from Republic Hot Rolled Carbon Special Sections. The component parts were cold formed by broaching. Tapping and drilling were the only other machining operations necessary. You can apply this economical method of mass producing steel parts where the section conforms to the predominating cross section of the part. Republic supplies hot rolled special sections in carbon, alloy and stainless steels.



FOR HOISTING, HOLDING, HAULING, TOWING, BUNDLING, you can count on Republic Chain for greatest safety and dependability. Republic's Round Chain Division makes a complete line of welded and weldless chain for every industrial requirement—every type of fitting, attachment and accessory. Strategic location of Republic Chain plants and warehouses assures you of prompt delivery

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Please send more information on:

- ☐ Free-Machining ENDURO
- ☐ Hot Rolled Bars
- ☐ Chain
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THE WORLD'S LEADER IN LOCKERS, Republic's Berger Division offers a wide selection of standard steel lockers for every industrial use. Modern design assures full-time protection for personal property. Handles are tamper-proof, cannot be removed. Continuous door strikes along sides prevent insertion of tools for prying. Berger offers a complete locker planning, engineering and installation service.

helps control costs on highly machined stainless parts

These stainless steel plungers for pneumatic and hydraulic control valves require 30 separate machining operations in producing them. Costs could be expensive. But the manufacturer controls them by using Free-Machining ENDURO Stainless Steel Bars.

Republic's Union Drawn Division produces cold drawn bars with a fine surface finish, close tolerance, accuracy of section, uniform soundness for fast, economical production on highly machined parts like these. Free-Machining ENDURO provides the added strength and corrosion-resistance of stainless steel. Two grades, A.I.S.I. 416 and 430-F, are fully 90% as machinable as Bessemer Screw Stock.

Thus, you can apply the high physical properties and corrosion resistance of stainless steel to your duplicate steel parts—and still maintain economical, automatic production—by switching to Free-Machining ENDURO.

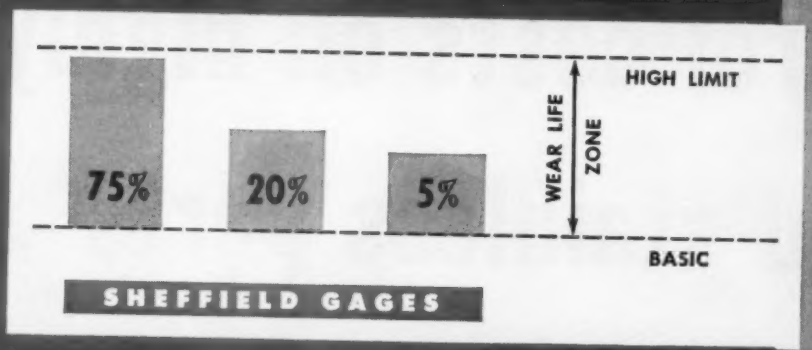
Republic ENDURO Stainless Steel is available in all forms, including hot rolled bars, special sections and wire. Republic metallurgists and engineers will give you expert assistance on applications, processing and use. Specify ENDURO on your next order for stainless steel bars. Mail the coupon for more information.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

WHY SHEFFIELD THREAD GAGES Wear Longer

Especial supersensitive production equipment controlled by high amplification instruments, plus Master Craftsmen make it practicable to hold the finished size of Sheffield thread gages unusually close to the gagemaker's high tolerance limit.



Purchasers of Sheffield thread gages can, on the average, expect to receive 75% of them within the upper third of the gagemaker's tolerance zone. 20% about half way and the rest between that point and basic.

SPECIFY SHEFFIELD and get more for your gage dollars.

SPECIFY "Reversible" Thread Plug Gages and save even more.

Gage Division, The Sheffield Corporation
Dayton 1, Ohio, U.S.A.

See us at the
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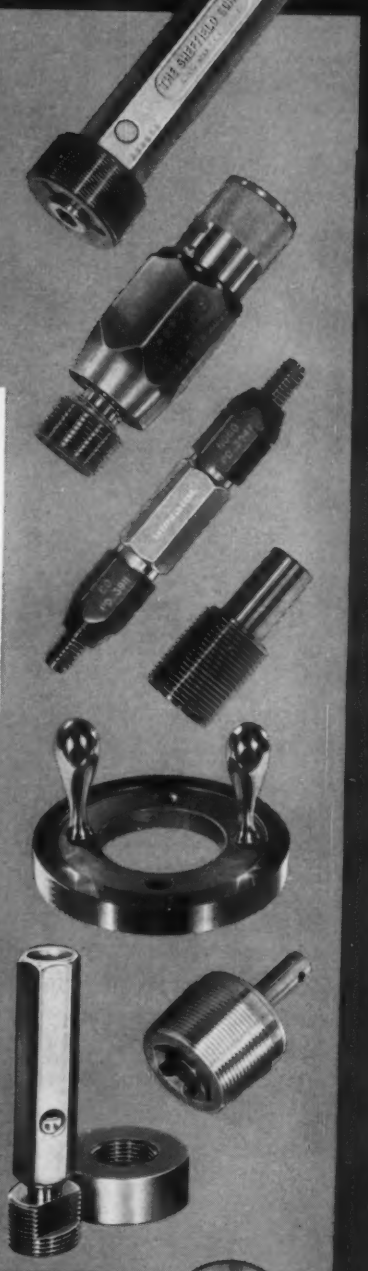


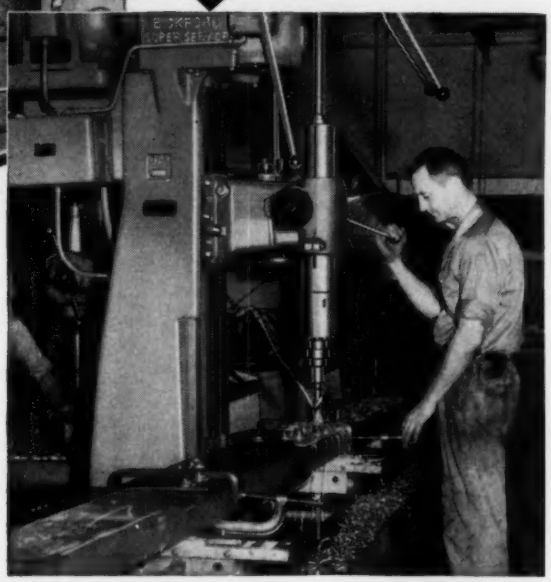
MASTER CRAFTSMAN SHEFFIELD HEADQUARTERS

SHEFFIELD

MANUFACTURING AND MEASUREMENT FOR MANKIND

The 9" dia. column 3' arm Cincinnati Super Service Radial is working on chassis frame parts and aluminum steering column brackets; ¼" dia. to 1¼" holes drilled and reamed to a .0015" tolerance.

The Upright Drill shown is one of six 28" Super Service Uprights working on heat treated alloy steel frames.



Money-making Cincinnati Bickford machines ... at The Autocar Division, WHITE MOTOR CO. —EXTON, PA.

Photos courtesy the Autocar Division of The White Motor Company, Exton, Pennsylvania.

Speed and easy handling—power and accurate, steady performance were factors in the selection of Cincinnati Bickford Super Service Radial and Upright Drills in this plant. They are quickly adaptable to a variety of operations, including drilling, reaming, tapping and trepanning.

For rapid, accurate, dependable production investigate these cost reducing modern drilling machines.

Write for Bulletin R21C.

80 YEARS OF SERVICE

CINCINNATI BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.

MAINTAIN the EFFICIENCY
of your
AUTOMATIC LATHES
and TURNING MACHINES
with the
OLIVER
20" TEMPLATE (controlled)
TOOL BIT GRINDER

The instant you equip your toolroom with an efficient Oliver, grinding time will be sharply reduced . . . . production immediately expedited.

The Oliver method of single point tool sharpening utilizes a controlled and numbered template . . . grinds the complete tool in a single operation on one machine. The simple-to-operate 20" Template Tool Bit Grinding machine grinds single point tools in a fraction of the time required by other methods . . . reduces grinding time on tough tungsten-carbide work as much as 100% to 500% (using a notched wheel, with water on the wheel and through the wheel, makes this possible). Where quantities of precision-ground duplicates are required, the Oliver Way is the BEST!

Single point cutting tools machine ground on an OLIVER TOOL BIT GRINDER provide lasting accuracy *essential* to the efficient operation of automatic lathes and turning machines. Ground on an Oliver, single point tools have a fine finish . . . meet top standards without requiring the usual second operation of diamond-grinding. An OLIVER 20" TEMPLATE TOOL BIT GRINDER is a small investment for your toolroom that is sure to pay large dividends.

We'll be glad to tell you more—just write, wire or phone.

OLIVER INSTRUMENT CO.
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Backlash

EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

'Prentice Problems

Recruiting apprentices for the trade is becoming a serious problem. Those who possess the necessary aptitudes generally seek positions more financially remunerative. It is not uncommon to find relatively unskilled workers earning a higher wage than a skilled diemaker. This is particularly true when the semiskilled worker is on an incentive basis.

Many of the building trades offer higher earnings and require considerably less skill than is required of the diemaker. And I know of no trade that requires so expensive an outlay for personal tools.

The potential tool and diemaker must possess above-average ability in many things. He must be naturally mechanical, have good coordination, be mentally alert and ingenious, and have good vision. He should have a high scholastic record, and should preferably be a vocational school graduate. Mathematics should come natural to him, and he should be well versed in geometry and trigonometry.

During the past 15 years, flat, across-the-board wage increases have narrowed the spread between the wages of the skilled and the unskilled. Small wonder that it is difficult to get desirable candidates and keep them interested during the long training period at below-average wages, and to keep them on the job after they have completed training.

Usually, a man good enough to become a tool and diemaker is smart enough to see a better future in something else. A workable solution to this widespread problem is yet to be found.

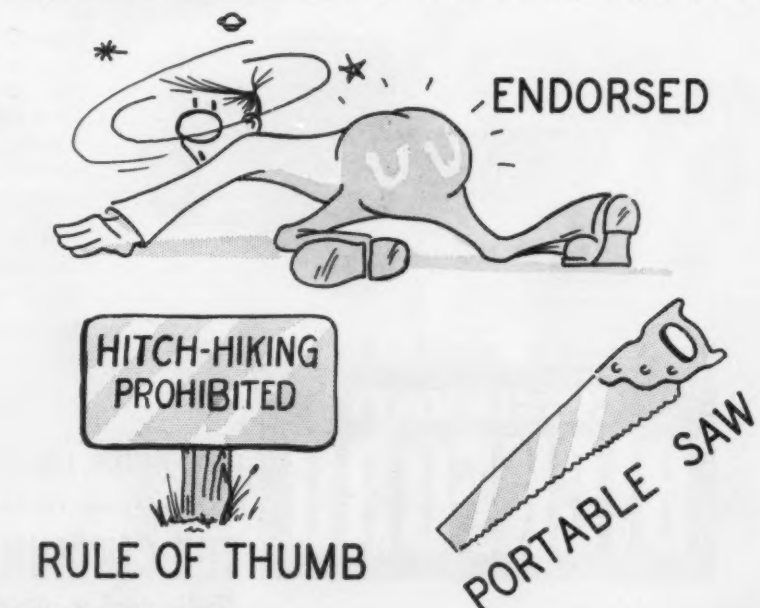
Clarence B Winch
Tonawanda, NY

SKIVING

I am much interested in the complete and informative Special Report on Skiving, (*AM*—Feb 14 '55, p121). Associate editor J P Wright is to be congratulated in getting so much data on a little-known subject. It is, however, difficult to understand why this method of form turning has remained almost unknown for so many years. As the

GRINETICS

By D G SMITH



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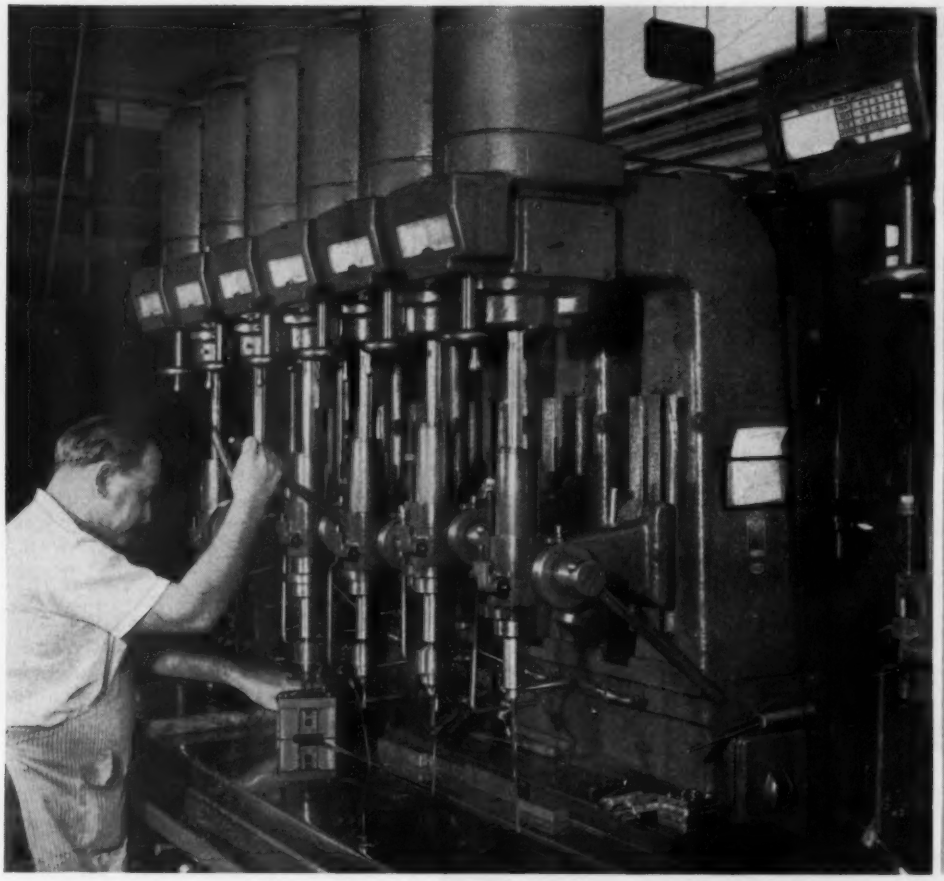

for **W. H. NICHOLS Company**

Precision holes ⊕ Mass produced by LELAND-GIFFORD DRILLING MACHINES

Producers of high speed, high precision metering and gerotor pumps . . . manufacturers of one of the most precise milling machines ever made — W. H. Nichols Company has a world-famous reputation for the quality of its work and the excellence of its production facilities.

For the many precisely located, exactly sized, and precision drilled holes involved in its operations, W. H. Nichols Company relies on the built-in accuracy of Leland-Gifford Multiple Spindle Drilling Machines. The flexibility of multiple spindles, the convenience of centralized controls, plus the Leland-Gifford indicating shift for instant, accurate speed changes . . . all contribute to fast, error-proof handling of precision work.

If you have a drilling problem — or want bulletins on the newest Leland-Gifford Drilling Machines, call the office nearest you.

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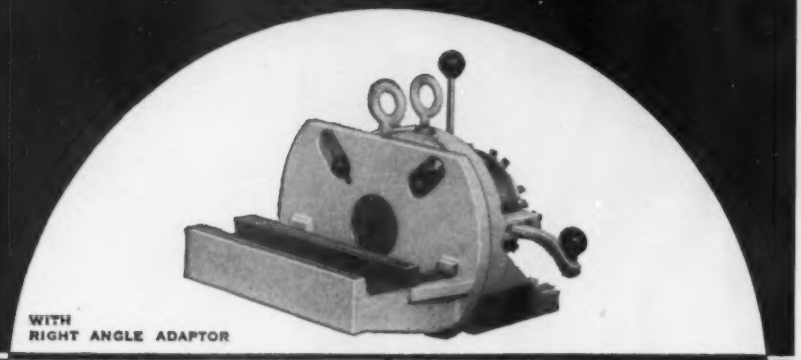
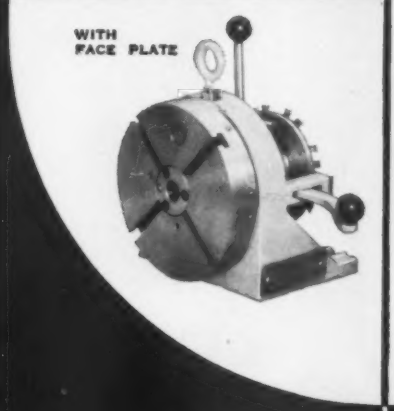
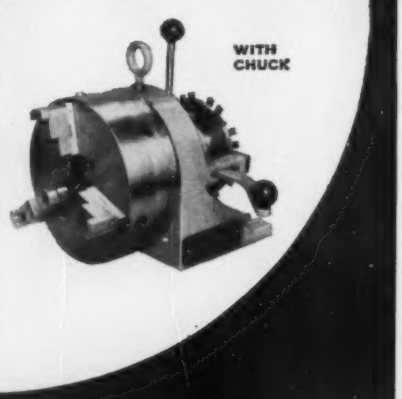
..."one of the most useful pieces of equipment in metal working plants throughout the country."



WITH RIGHT ANGLE ADAPTOR



WITH FACE PLATE



WITH CHUCK

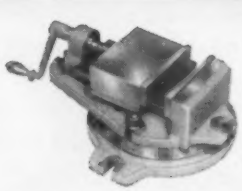
3-WAY

INDEXING TRUNNION

Gives new, *simple* mounting of work or jig plus rapid, controlled rotation to correct angular positions. Used on radial drills, boring mills, planers, milling machines, and sensitive drills.

This is a basic, versatile production unit which speeds up multiple same-piece operations on either long or short runs.

Request Bulletin J7 for complete details.



STURDY, ACCURATE machine vises, made with more than the usual care. Available with or without calibrated swivel base.

UNIQUE, SIMPLE work holder for indexing and positive clamping of difficult parts in milling or pantograph operations.

EST. J&B 1870

JOHNSON & BASSETT, INC.

PRODUCTION TOOL DIVISION

WORCESTER, MASSACHUSETTS

author says, there have been almost no data available over the years. Although seemingly unknown, it is by no means a new process.

I have not looked up patent dates. Perhaps it was never patented, although I think it was, by my old friend Walter Lee Cheney, before the turn of the century. Walter was rather closely related to Amos Whitney and learned his trade in the Pratt & Whitney shop, along with John J Grant, well known in the early days of *AM*. I first met Walter Cheney about 1889, when he was building what he called a forming lathe for use on brass parts.

The little shop in Meriden, Conn, was called the Meriden Machine Tool Co, as I remember. I visited it about 1897. The form or skiving tools were fed under the work. One of the stockholders was John Johnston, then chief draftsman for Pratt & Whitney, who soon after became the second name in Potter & Johnston.

Walter Cheney was one of my best friends. He was one of my sponsors for ASME 60 years ago, and was the co-author of my first book, Machine Shop Arithmetic, published in 1895, before the days of quick change gears. It was designed to help machinists figure gearing for thread cutting, to know about tapers and other shop problems of the day, and was a great help in many ways. It seems as though his pioneer work in what now seems to be a new process should be known. Had he received adequate financial support it is probable we would have long ago benefitted by his pioneering in the art of skiving. Probably few knew of Cheney's connection with skiving lathes. He was sales manager for the Lucas Machine Co for years before he died.

Fred H. Colvin
Point Pleasant, N. J.

Their Own Fault

I have enjoyed reading your three editorials (*AM*—Dec 6 '54, Dec 20 '54, and Jan 3 '55). You do hit the nail on the head pretty well, but there is one small punch you have

THE MACHINE TOOL

left out: men such as Reuther forget what caused a lot of this automation.

You will remember that when we had Governor Murphy in Lansing, we had sitdown strikes at Chevrolet, in Flint. At that time we had not only sitdown strikes, but laydown strikes, falldown strikes and, worst of all, slowdowns. We have been putting up with this slowdown for 10 years, and industry has just had to do something to cope with it. It is the Union's own fault that they accelerated automation. I do not think there is any question but that it would have come along in its regular time, but the unions have hurried it.

Name witheld
Detroit

Pickled Iron

In reference to your Backlash item entitled "Hard Iron," (*AM*—June 7 '54, p106) I would like to suggest:

Some two years ago, there appeared an article about a new method of machining cast iron. I am not sure whether it appeared in *AM* or in *Product Engineering*, but it consisted essentially of putting the castings in a closed lead tank containing hydrofluoric acid for several hours. As you know, the main difficulty in machining cast iron results from the hardness of the silicious crust. Therefore, the only available method of removing this vitreous crust is to dissolve it with the acid.

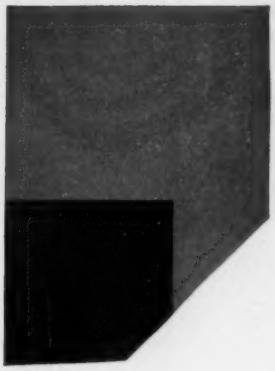
We have not yet applied this method because our machining of this kind of material is not big enough to justify construction of the suitable tank. But perhaps in this instance it will pay to try. Of course, annealing is not necessary.

The author of the new process claimed that, with his method, castings can be machined "like butter."

J Sacristan Castello
Standard Electrica SA
Madrid, Spain

The article in question was entitled "Acid Pickle Doubles Tool Life on CI" (AM—June 11 '51, p140). *It was based on experiments made at University of Michigan.*—Ed.

for Special Service on Carbide "Specials"



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When your production machining problem dictates the use of special carbide tooling, your nearby Gorham Field Engineer can give you the right answers fast! He's an expert in the design and application of special cutting tools . . . and he provides a complete engineering service to determine your exact requirements.

He begins with your product, sketch or idea. He surveys your production operations and available equipment. He considers work material properties and required finishes and tolerances. He plots speeds, feeds and methods of tool driving. Then he develops practical design and metallurgical specifications for a special tool that's "tailor-made" for your application. And his recommendations are backed by Gorham's more than thirty years' experience in the design, manufacture and heat treatment of fine cutting tools.

Yes, your nearby Gorham Field Engineer is a helpful man to have around! If you haven't yet met him, write for his name, or send details of your problem direct, and we'll have him get in touch with you promptly.

Gorham TOOL COMPANY

"EVERYTHING IN STANDARD AND SPECIAL CUTTING TOOLS"

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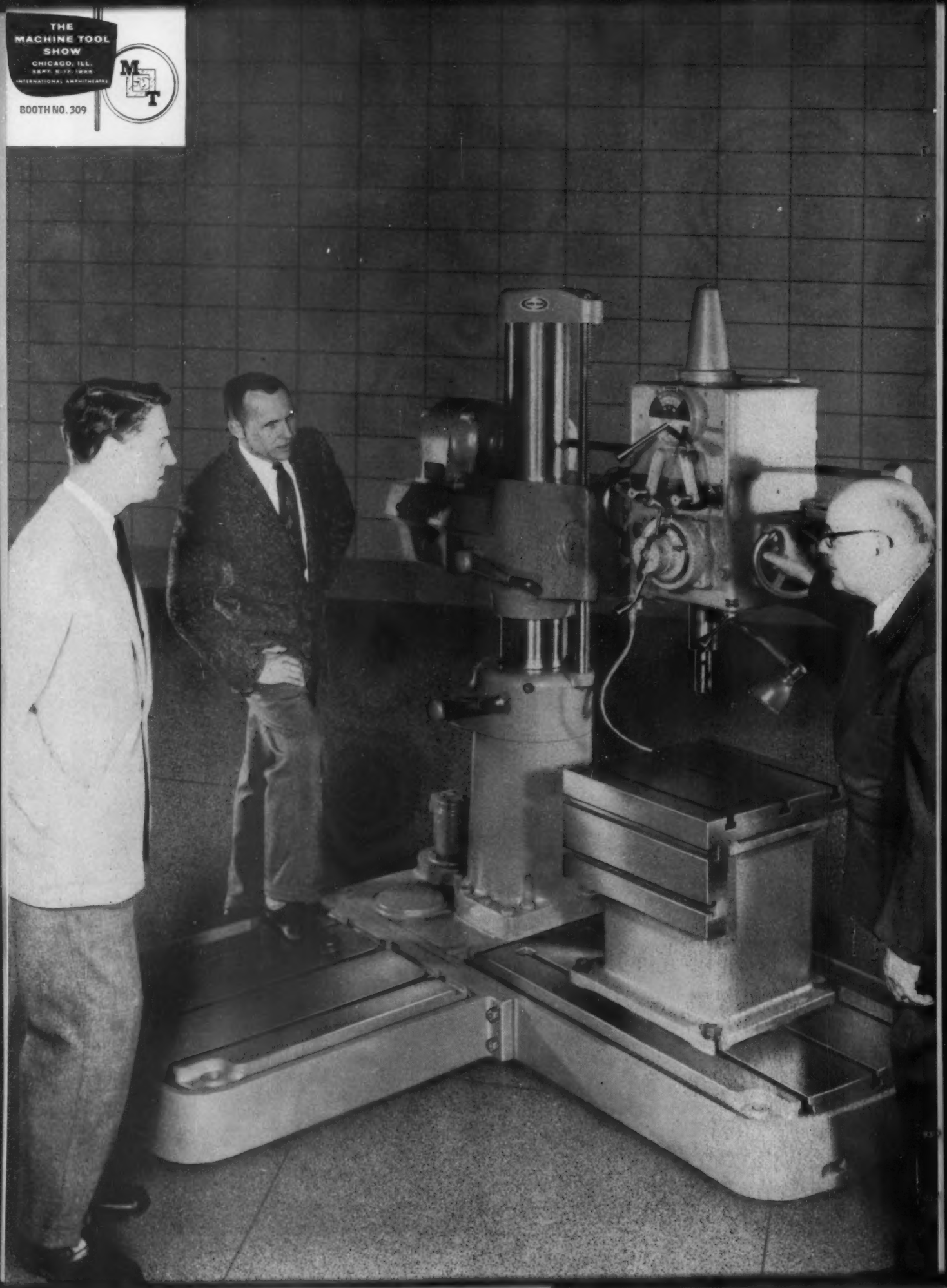
WEST COAST WAREHOUSE: 576 North Prairie Ave., Hawthorne, Calif.

Easy to operate. Controls for 9 spindle speeds, 6 power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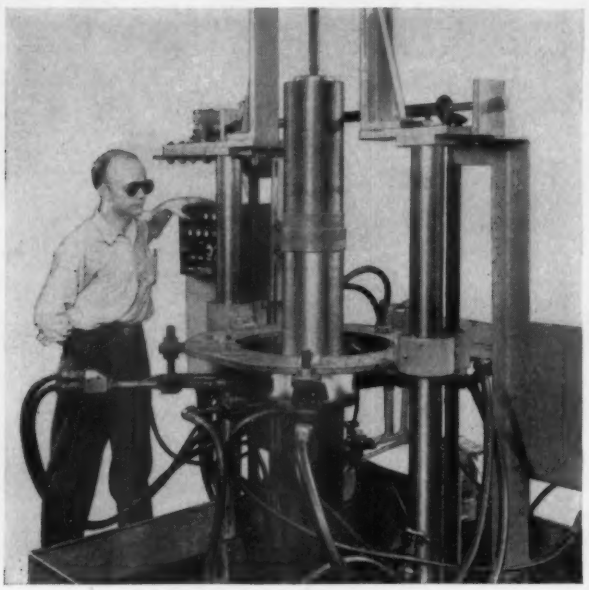
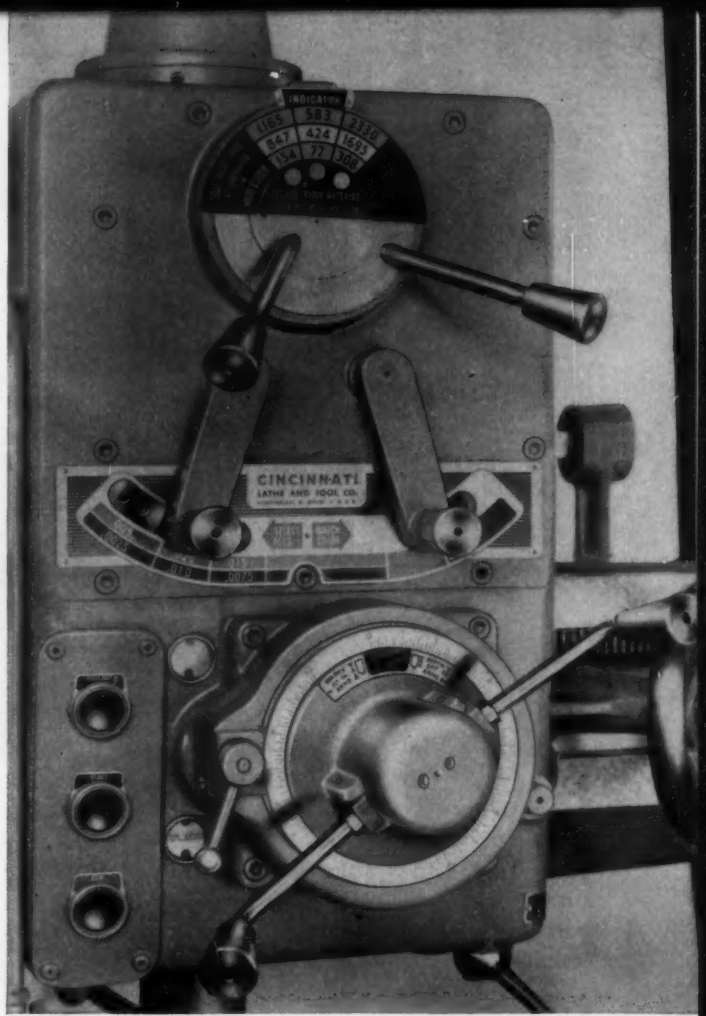
BOOTH NO. 309

Easy to operate. Controls for 9 spindle speeds, 6 power feeds grouped conveniently for the operator. Simple color-matched speed and feed selection dials. No. 3 Morse taper spindle; 1¼" capacity in cast iron. Unit construction throughout; hardened steel gears; forced-spray lubrication.

Flame-hardened column. 7½" FLAMATIC hardened column provides a rigid cylindrical way for the 3' arm. Column is mounted on heavy-duty, antifriction roller bearings in a sturdy column support. Waffle-ribbed base of adequate floor area and weight to provide stability.





NEW LOW-COST CINCINNATI RADIAL DRILL RETAINS BUILT-IN ACCURACIES

FIRST WITH A HARD CLAD COLUMN

Researched—in the company's laboratories. Problem: how to retain built-in accuracies and prevent column scoring.

Engineered—to provide a thick-walled, centrifugal casting of close-grained iron; accurately turned on modern, high-speed lathes; surface hardened; then ground to close tolerances and a mirror-like finish.

Tested—by subjecting the new column to years of round-the-clock operation.

Approved—by the men who know machine tools best—the users.

Priced—attractively for contract and job shops, toolroom and maintenance use, and manufacturing plants.

Available—*now* from CL&TCO authorized machine tool dealers in all major centers. Write to Cincinnati Lathe and Tool Co., Cincinnati 9, Ohio, for catalog D-133 and name of nearby dealer.

LOOK FOR THIS TRADEMARK

CINCINNATI LATHE AND TOOL CO.

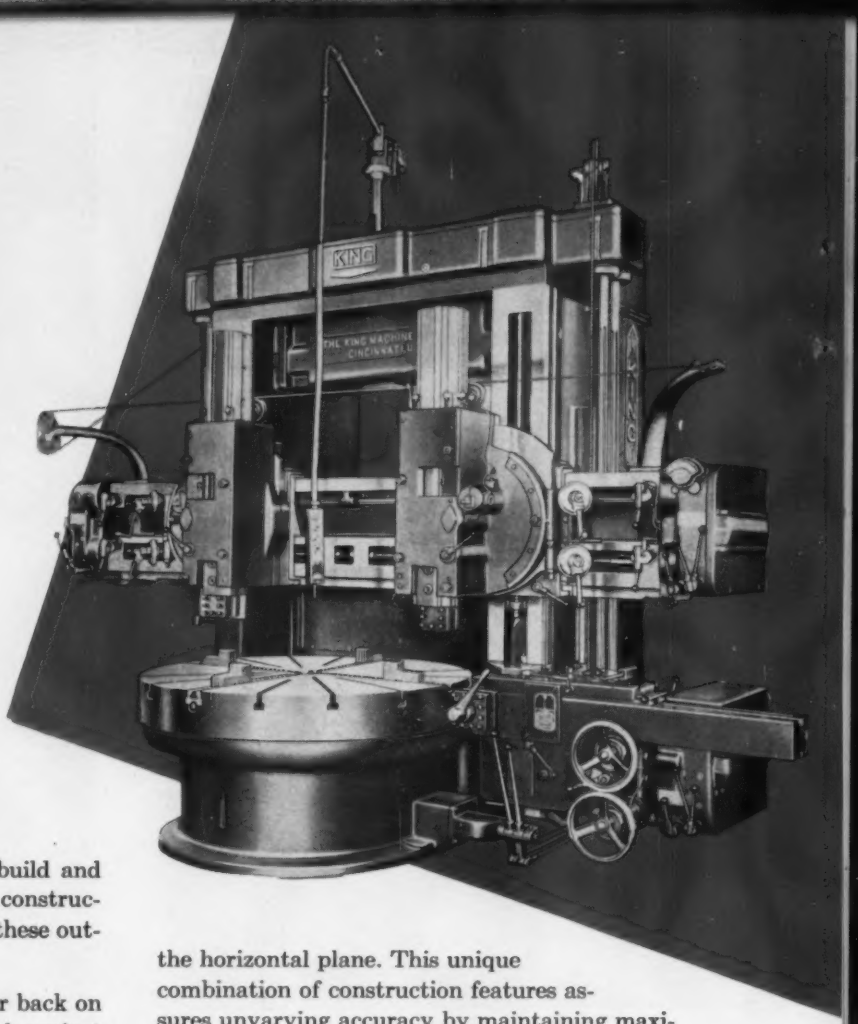
FLAME-HARDENED *HardClad* COLUMN

KING

VERTICAL BORING AND TURNING MACHINES

Are Built Extra-Rugged, Extra-Rigid, For

Consistently High Accuracy

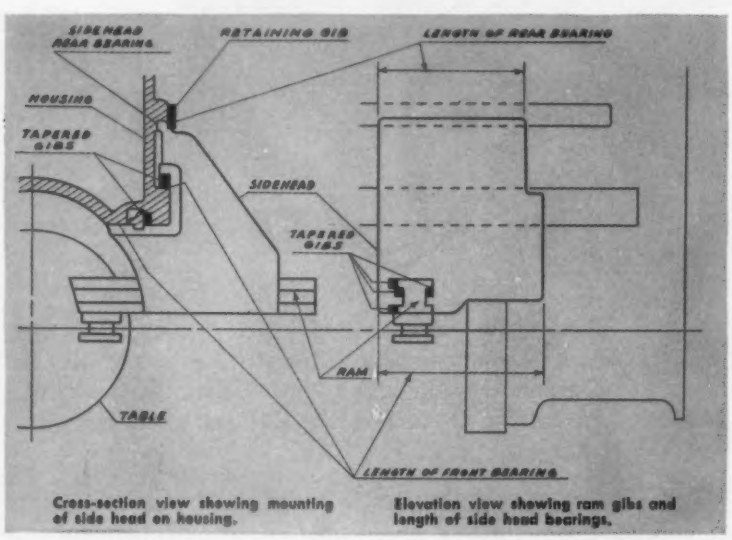


Typical of KING® superiority in rugged build and sturdily maintained rigidity is the side head construction illustrated and described here. Compare these outstanding construction details:

A full-length side head bearing is mounted far back on the side of the machine housing, extending back against the housing and held by a retaining gib. The other side head bearings are sturdily gibbed to the housing guides at all points of possible rotation, using adjustable tapered gibs. The accuracy of the ram within the side head is maintained by adjustable tapered gibs, two for adjustment in the vertical plane and two for adjustment in the horizontal plane. This unique combination of construction features assures unvarying accuracy by maintaining maximum ram and side head rigidity with resultant maximum resistance to deflection of the ram or rotation of the side head in any direction.

Extremely heavy cuts can be taken with the side head at feeds and speeds even beyond the capacity of the best modern cutting tools. Accuracy is maintained under the most severe conditions—such as work on pieces of small diameter in relation to table diameter, where the ram, extended inward, has considerable tendency to cause rotation of the side head.

This kind of *extra quality* construction *throughout* KING machines is your best guarantee of accurate, dependable performance. For full details see your King Distributor, or write us direct.



Cross-section view showing mounting of side head on housing.

Elevation view showing ram gibs and length of side head bearings.

THE MACHINE TOOL SHOW
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VERTICAL BORING & TURNING MACHINES

Spot News of Metalworking . . .

Automatic machine that "triggers" punches in practically any hole pattern combination for printed-circuit components has been developed by Radio Corp of America, and will sell commercially for about $14,500. Master holes are punched in glass-based cloth tape, which then guides the machine's punches.

Plastic tool tryout before making steel dies for production runs is reported to be standard practice with one major auto manufacturer.

New England plants that have pulled out to take advantage of cheaper labor and tax advantages in South are reported to be regretting their move. Unskilled labor is plentiful enough, but skilled help and "aggressive" engineers are at a premium. Added to that, business back home in New England is booming. Example: one industrial center that was on a 30-hr-or-worse workweek in 1954, reports area workweeks run 45-58 hrs.

Krupp of Germany now wants to beat swords into plowshares. One of the notorious "Merchants of Death," and a prime industrial mover in two World Wars, Krupp now says "rearmament in the age of atom bombs is no longer a question of steel production and processing," now wants Allied restriction lifted so the firm can resume coal mining and steelmaking.

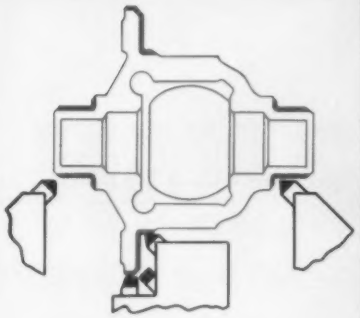
Kaiser Aluminum may be eased out of the AF Heavy Press Program. Kaiser built, and has a letter contract to operate, the Air Force's Halethorpe, Md, plant (two 8000-ton extrusion presses). Now the Air Force is asking such firms as Reynolds Aluminum and Harvey Machine Co for bids to operate the plant. If Harvey wins out, it will have almost 90% of total Air Force heavy extrusion press capacity.

Government's "working inventory" of titanium is piling up fast in U S warehouses and at processing plants. Reason: output has jumped from 2500 tons in 1953 to 7200 tons a year today, but military-only consumption is still only 1200 tons a year, and there's little civilian market.

Freak foundry accident hospitalized 48 workers at National Malleable & Steel Castings Co, Cleveland, when air currents carried exhausted carbon dioxide back into the plant through air-intake valves.

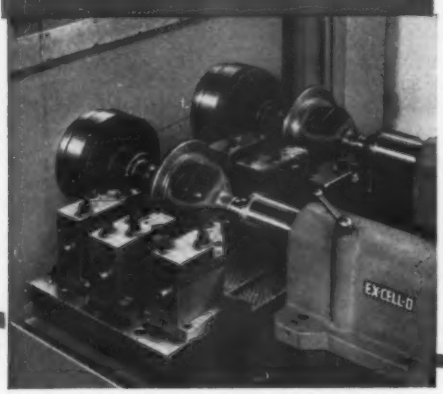
Eight patents are claimed for Poland's first single-spindle automatic, shown at the recent Leipzig Fair. Among them: pairing of steel change gears with ones made from bakelite-impregnated silk, a powder-filled barstock carrier — both of these developments designed to cut noise, ducting of cutting oil inside the tool frame, spring-loaded split gear on cam-shaft drive, micrometer adjustment on each tool holder. For more on the Leipzig Fair, see p 162.

Full study of the machine tool industry will be undertaken by the Senate Small Business Committee to make sure of avoiding a foul-up like that of Korea if another emergency arises. Committee has recommended, among other things, that no U S machine tools be leased unless the leasing would help national mobilization readiness. (See p 91).



Heavy lines show the surfaces machined.

Style 112-C Ex-Cell-O Precision Boring Machine with double set-up.



Close-up of the two differential cases, in work position. This precision work is done with hydraulic feeds and easily-controlled automatic cycles.

Insure your Profits...

with DOUBLED PRODUCTION on Ex-Cell-O STANDARD MACHINES

THE MACHINE TOOL SHOW CHICAGO, ILL.

XLO EX-CELL-O *for* PRECISION

A NEW APPROACH . . . Turn four diameters—face three shoulders—chamfer one edge. Not one at a time—but *Two!* Not on a double end—but on a single end Ex-Cell-O Precision Boring Machine!

Workpieces are automotive differential cases—precision work—limits of plus or minus .0005" on diameters.

See how Precision Boring Machines can save time and money for you. Call your local Ex-Cell-O representative, or phone or write Ex-Cell-O for a Precision Boring Catalog.

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Washington . . .

Government machine tools . . .

In an effort to avoid recurrence in a future emergency of the chaos that plagued the machine tool industry in the Korean crisis, the Senate Small Business Committee intends to make a full study of the industry during this session of Congress. Sen John Sparkman of Alabama is committee chairman.

Committee recommends a complete inventory of all U S-owned machine tools be expedited, and that tallies of various agencies owning tools be standardized and brought together in one master list that can be used by all government branches.

No government-owned equipment should be leased for non-defense production unless and until it can be clearly shown that it would add to national mobilization readiness, the committee agreed. Exceptions should be on an individual basis, rather than a case-by-case finding.

Government machines should be withdrawn from private contractors' production lines as soon as possible, in the committee's opinion. This would call for a transition period, during which contractors can replace U S equipment with their own. Meanwhile, an expert group, including representatives of the machine tool industry, should study rental to bring them in line with private rental plans, thus removing the competitive advantage of firms renting government equipment at low fees.

The Armed Services should immediately draw up a preference list giving priority ratings to various military items as a guide available to the machine-tool industry whenever needed. The committee added this list should be updated frequently.

The committee also recommended that a study be made of the impact of foreign-made machine tools upon U S industry. It also suggested that the Office of Defense Mobilization find out right away if its controls plans will speed or hinder rapid expansion of emergency machine tool output.

Mobilization probes . . .

A Congressional investigation of the Pentagon's new procurement policy is in the works. The policy puts new emphasis on multiple sources of supply, provides that contracts can be let to higher bidders when this helps maintain a broader base.

Sen Lyndon Johnson's Armed Services Preparedness Subcommittee — the well-known "watchdog" committee on defense — wants to find out how seriously the new policy is being carried out. Then the Senate Small Business Committee wants to determine if the policy will hurt small firms. Sen George Smathers will head the Military Procurement Subcommittee looking into the matter.

New dispersion policy . . .

Washington is revamping its industrial dispersion policy. Up to now, ODM has granted fast tax write-offs only to new defense plants built at least 10 miles outside critical target cities. But in light of new knowledge about H-bomb fallout, this isn't really much dispersion.

An inter-agency committee is coming up with a new policy. Lt Gen Willard S Paul (Ret), ODM's top man on industrial defense, heads the group. The committee is likely to redefine the 70 critical target areas — extending the target zones for policy purposes, taking into account the fallout peril. It's unlikely that the committee will set up any new mileage yardstick for location of new plants, however. The idea now seems to be that each plant proposal will be considered on individual merits, taking into consideration factors such as prevailing wind currents in the area, terrain, and the like.

Aluminum shortage . . .

Washington has taken some pressure off the aluminum shortage. The scheduled stockpile take has been cut by 75,000 tons until July. And export controls have been slapped on aluminum scrap. Government officials feel this is enough to ease the shortage. But if aluminum is still tight during the summer, more government relief is likely.

The shortage stems from several factors: (1) heavy buildup of aluminum inventories lately, following a drain on consumer stocks last year; (2) scare buying spurred by Formosa; (3) drop in Canadian shipments as European demand rises; (4) entry of secondary aluminum users into the primary market, following a hike in scrap prices.

Free trade in trouble . . .

Eisenhower's bill to extend the Reciprocal Trade Law may be amended in the Senate to favor those US industries who have been complaining about competition from abroad.

The Senate — which had been counted on to give the president's request 100% approval — now seems bent on writing protection for US industry into the law. Textiles, chemicals, bicycles, chinaware, oil, coal, electrical machinery — these industries and more are surprised to find that Senators are taking heed of their demands.

Biggest single factor is the kind of strength the President brings to bear on Senators who are feeling the pressure from industries at home.

The man who needs a new machine tool and doesn't buy it is paying for it anyway...

in high maintenance costs

LOOK beyond the age of your equipment when considering whether maintenance costs indicate your need for new machine tools. The design of equipment and the method of processing used are equally important factors.

For example, fast spindle speeds and the necessity of maintaining perfect alignment between spindle and the fixture or chuck, call for frequent adjustment, repair and replacement of parts.

You can greatly reduce such maintenance costs through the Microhoning* process—which employs comparatively slow spindle speeds and self-alignment of tool and workpiece. And the design of Microhoning equipment makes easily accessible all components likely to require servicing...follows industry-accepted standards, such as the J.I.C. electrical and hydraulic codes, to provide greater safety to both operator and machine.

In reviewing your processing methods and equipment, you may discover your maintenance costs are greater than the price of new Microhoning equipment. In short, you may be paying right now for new machine tools you don't have.

PART:

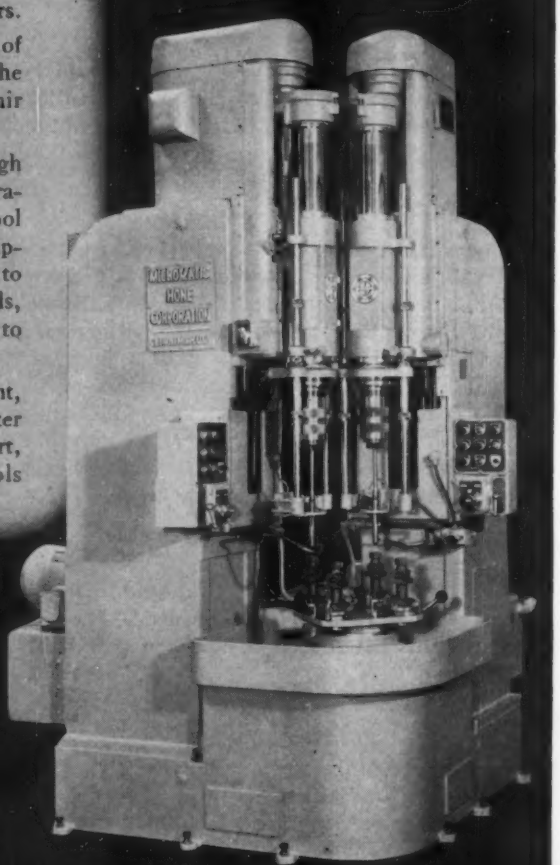
Cluster gear—bore must be straight and concentric with gear teeth.

PROBLEM:

Excessive maintenance costs on fixture driver and chucks.

SOLUTION:

MICROHONING—Simple stationary fixture—self-aligning tools—straight bore concentric with gear teeth—increased production.



*MICROHONING = STOCK REMOVAL + GEOMETRY + SIZE CONTROL + SURFACE FINISH

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Detroit . . .

If management can't be sure . . .

. . . what any one year's worth of guaranteed wages would cost, it might be further discomfited by the knowledge that practically none of the union members who are gunning for GAW this year have any inkling as to cents-per-hour costs, either.

CIO's United Auto Workers Union has been mulling over annual wages for years, and it would seem a reasonable expectation that someone would have a fairly close estimate of costs as they apply to particular companies.

It's safe to say that Nat Weinberg, UAW's astute economist, has projected costs for certain companies. But he and Walter Reuther, UAW President, have succeeded in keeping as quiet about that matter as have Ford and General Motors.

Among the many delegates at UAW's convention in Cleveland who were questioned about the union's aims, not one had any comprehension of GAW costs, or total package costs (the package also includes demands for higher wages, larger pensions, increased insurance, shorter contracts, etc.

"It must be all right" . . .

The delegates' viewpoint, in an unrefined state, appeared simply to be: "Walter is after it . . . it must be all right."

That, too, was approximately the sentiment of George Meany, AFL President, who brought an effective speech to the convention. UAW, said he, is "blazing trails" with GAW; while in "some industries, it would not be practical (and while) I don't know enough about the auto industry . . . I'll take Walter Reuther's word for it." He was, he added, "rooting" for UAW.

Strike Fund Aid?

Was he rooting enough to grant strike fund aid? Meany said that "no doubt if Walter Reuther asks for help, it will be forthcoming."

This was in reply to a previous call from the convention floor for a united AFL-CIO strike fund—a call which Reuther recognized by noting that "this idea of a united labor movement defense fund is something that I proposed 10 years ago and I hoped it might be possible when we got a united labor movement.

". . . the AFL groups and the CIO unions and the Mine Workers and the railway unions," said Reuther, "can create a . . . fund so that everybody in it will be financed by everybody's money . . ."

Rift in the ranks?

That was on the second day of the convention. On the third day, the same delegate—Ford Local 600 President Carl Stellato—who proposed the huge strike fund, was in trouble, as often before.

That day, Stellato was nominated as a candidate for a UAW vice presidency. In one of the most artful speeches ever heard by a UAW convention, Stellato sounded at the same time as though he were both declining and accepting. That gave him the chance to sniff sentiment as he went along, and when it appeared most favorable, he finally accepted. He also suggested that the union's present top echelon could use somebody who would not serve as a "rubber stamp" for Reuther—a comment that only served to get him into deeper trouble with the international's officers.

When a six-hour roll call vote was completed, Stellato had been soundly whipped by a margin of roughly three to one. A good many delegates who had cheered his acceptance speech didn't follow up by voting for him. Even so, he managed to establish minority faction of consequence—one large enough to put a grim glint in the eyes of Reuther—who has held a cordial hatred for Stellato ever since the latter challenged him on a dues increase four years ago.

Reuther, who brooks absolutely no wavering from his tight line of rule, can be expected to deal with Stellato at some time, but not now. Going into negotiations with Ford and GM, the union wants to appear to be perfectly united, dedicated down to the very last member to winning GAW. The antagonistic Local 600 will be nursed along so that no internal dissension will crop up to disturb UAW's immediate goals.

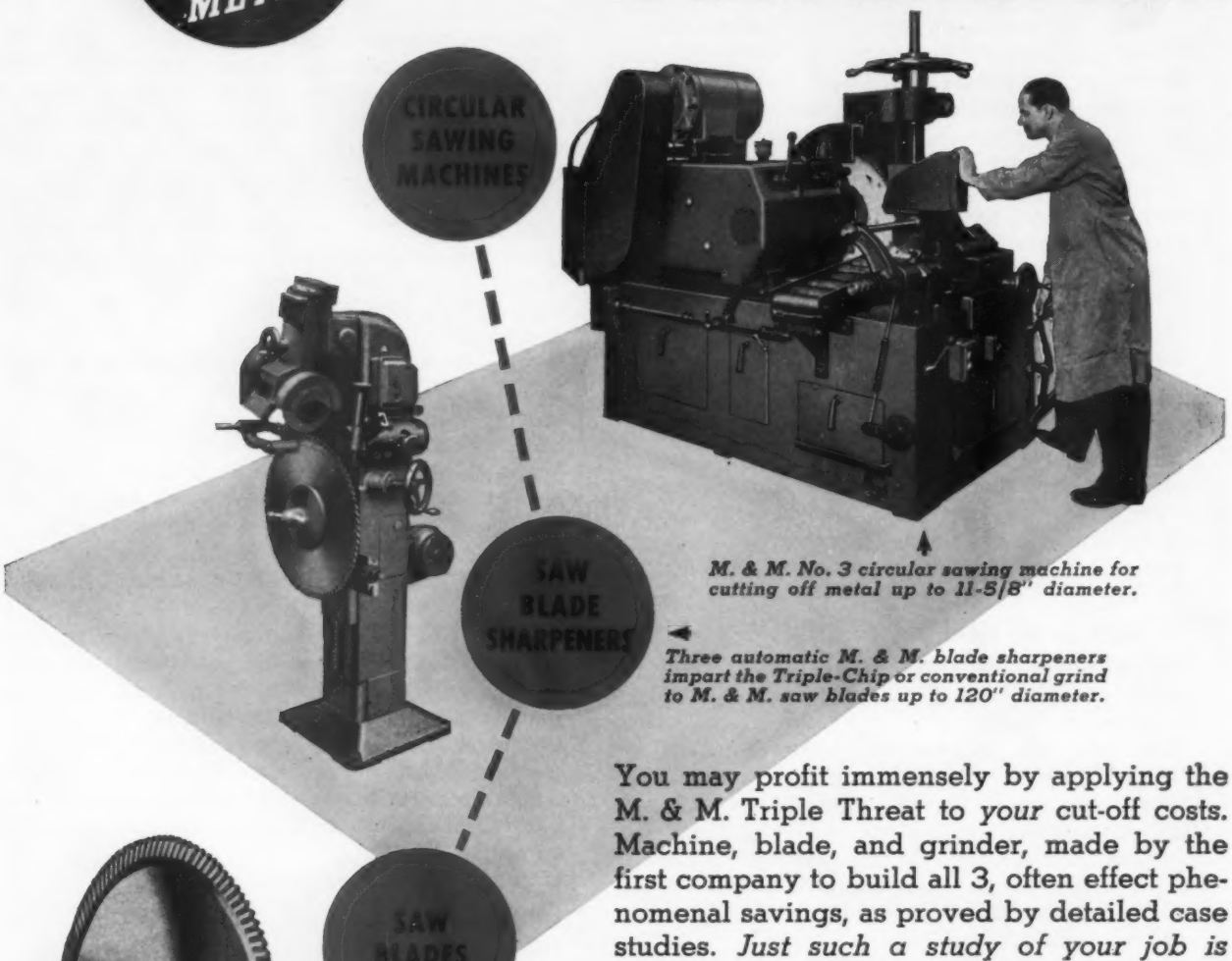
The target: Ford

The impression—without the proof—was evident, too, that Local 600 will be picked to spearhead the fight for GAW. More and more, the union seems to be sighting in on Ford as the No. 1 target this year. Not that GM can fully hope to go unmolested. It can't. But the simple fact is that the union could much better afford a strike at Ford, where it has about 140,000 members, rather than at GM, where it has about 325,000 members.

The $25-million strike fund, which the delegates overwhelmingly approved, obviously would carry a Ford walkout to greater lengths than would be possible at GM. Many delegates, without knowing any more about GAW and the mechanics of administering it other than that guaranteed wages are desirable, expressed that belief.

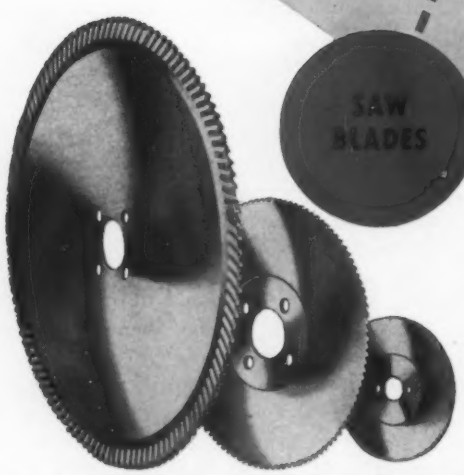
Reuther, planning to participate this month and next in negotiations with both companies, remains in the catbird seat insofar as strategy is concerned. He will be able to pit one company against the other and if both hold out, he can easily select as a strike target the least determined of the two.

THE Triple-Chip METHOD IS A *Triple-threat* TO HIGH CUTTING COSTS



M. & M. No. 3 circular sawing machine for cutting off metal up to 11-5/8" diameter.

Three automatic M. & M. blade sharpeners impart the Triple-Chip or conventional grind to M. & M. saw blades up to 120" diameter.



M. & M. saw blades cut any machinable metal. Cut-off blades: segmental — 11" through 120" diameter; solid — 8" through 20" diameter. Slitting saws — 3" through 8" diameter.

You may profit immensely by applying the M. & M. Triple Threat to *your* cut-off costs. Machine, blade, and grinder, made by the first company to build all 3, often effect phenomenal savings, as proved by detailed case studies. *Just such a study of your job is yours for the asking.* We offer you an unmatched experience in the sawing of metal, ferrous or non-ferrous, titanium to magnesium, from 1/4" to 43" diameter.

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Machine Tools . . .

Monthly orders around $60 million . . .

Machine tool sales have been staying close to the $60-million-a-month level since December 1.

In that month, they suddenly rose to that figure for the first time since September 1953. January and February brought little change from the December volume. March is believed to have been a good month too, though no official estimates are yet available. It would not be surprising if March matched each of the previous three months.

Much of the recent machine tool business has come out of the automotive industry. All of the Big Three have been buying; and Detroit is not through placing orders. On the other hand, no huge tooling programs loom in autoland.

A certain portion of orders in February and March, and even in January, was driven in just ahead of price advances. While there has been no general price increase in machine tools, a number of individual builders have upped prices recently.

Other builders are taking a close look at prices to decide whether to put them up or not.

Business has been sufficiently better since the first of the year that some builders have increased the work-week in their plants from 40 hours to 45 hours or more.

Cross to build new plant . . .

Special machinery builders, as one might expect, are more loaded with work than makers of general-purpose tools, though the latter report a nice improvement in sales too. Several companies in the special-machinery field have work-schedules well into 1956, though they have gaps between now and then into which they still can put new orders.

The Cross Co, Detroit, plans to begin construction this summer of a brand-new plant for manufacture of transfer-type machines on the northeast edge of the city. The new factory will add greatly to the firm's capacity to build special machines.

Inquiries for machine tools are heavy. What with the new orders placed the first quarter and the prospects for the year, machine-tool shipments in 1955 ought easily to total $600 million, as predicted earlier. This, incidentally, will be without benefit of much export business or defense work.

ODM lawyers kill components program . . .

Just as the so-called "Components Program" for turbines and gears was about to sweep through to final approval in the Office of Defense Mobilization, it struck a snag that sank it completely.

The program involves an expenditure of $62 million for reserve facilities for production of turbines and gears in an emergency. About $55 million of the total was to go for machine tools.

The newly-created Vance Committee gave its blessing to the program, which has been floating around Washington for months. Then it went to ODM Administrator Arthur Flemming, who it is reported signed it, or indicated that he would.

To be put into operation, however, the program needed the approval of the ODM Borrowing Authority Review Board. That was believed to be a perfunctory operation. But it turned out otherwise.

The legal counsel of ODM ruled that the defense production borrowing authority, with an original $2.1 billion at its disposal, could not be tapped for the purpose of the components program. Reason: government money would be going into the kind of project that would freeze the money. Up to now, the money has been used as a sort of revolving fund, with the money paid back periodically and reissued for further projects.

The money has gone, for instance, for stockpiling strategic materials. These stocks are drawn upon from time to time by defense contractors. The government thus recovering its money and spending it again for more raw materials.

Air Force program further delayed . . .

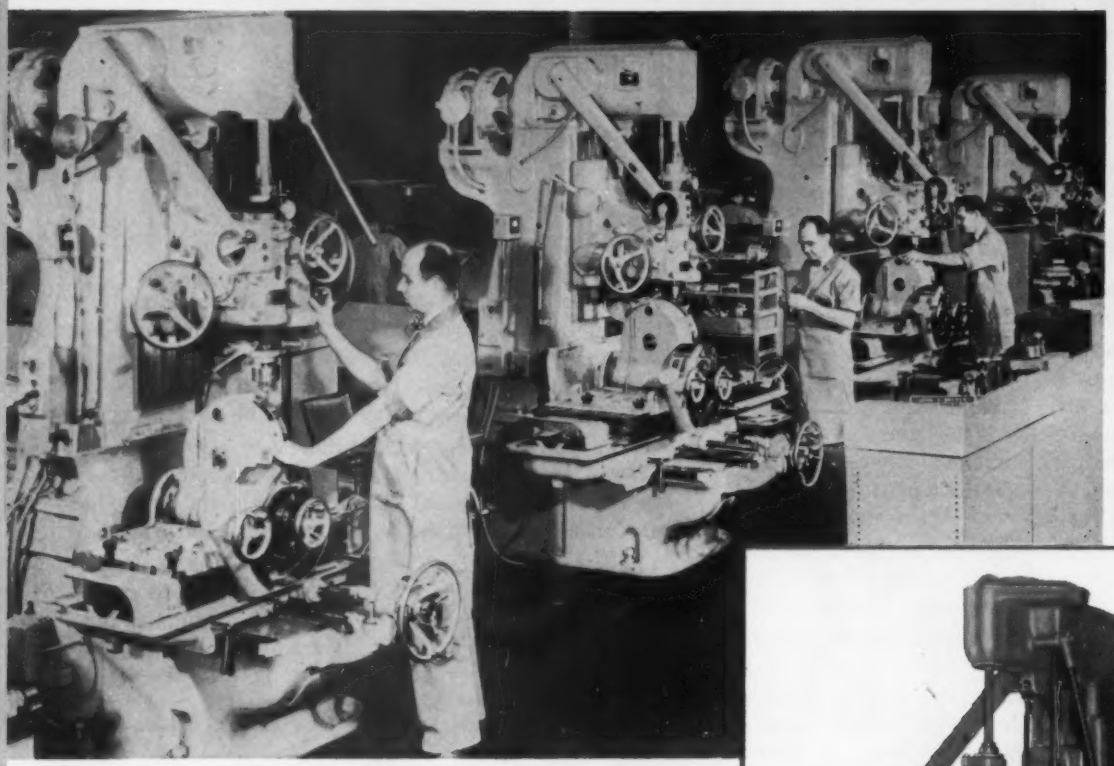
It is getting to be an old story to report delays in the Air Force's $84 million Reserve Machine Tool Program. But the truth is that the Air Force has been dragging its feet again and orders in volume will not be forthcoming until after May 1, if then.

Recent changes in materiel requirements of the Air Force are said to have made the high echelon in Washington cautious about making commitments.

Certain forces are at work, however, in convincing the big brass that the program, because of the standardization in tooling already worked out, is sound —no matter what design changes are made.

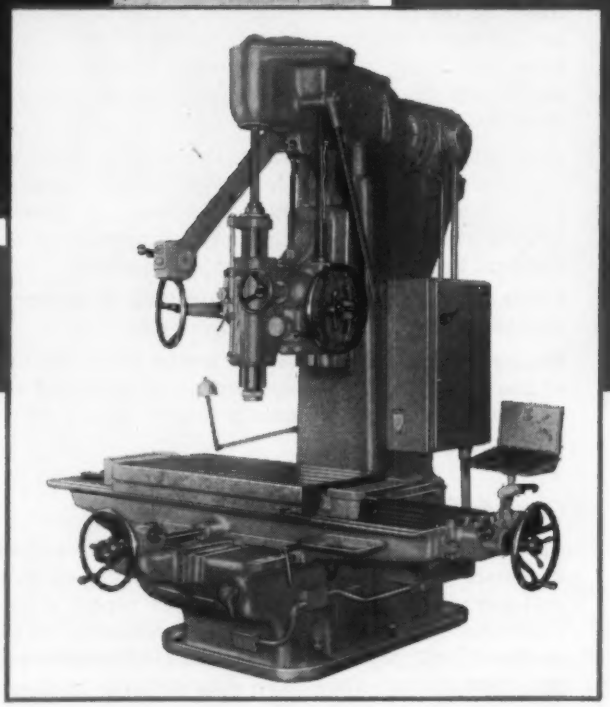
Moscow is reported to have cancelled the 26 huge horizontal boring machines that it ordered last year from a British builder. It is not known whether the Russians will try to place the business elsewhere or whether it wishes to demonstrate that it is in no way dependent upon the West for this type of machine.

East German machine tools were the most impressive of the behind-the-iron-curtain tools shown at the 1955 Leipzig Fair. For detailed story and pictures of the fair from our own correspondent, please turn to page 162.



A section of the Woodward Governor Company plant in Rockford, Illinois showing a line of four P&W No. 2A End-Measure Jig Borers equipped with P&W Precision Tilting Rotary Tables.

WOODWARD GOVERNOR COMPANY USES



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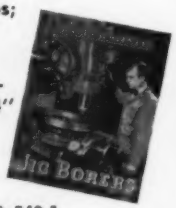
THE No. 2A —practical size for most shops; table 22" x 44"

also **THE No. 1 1/2B** —compact and versatile; table 12" x 24"

THE No. 3B —large, powerful; table 24" x 54"



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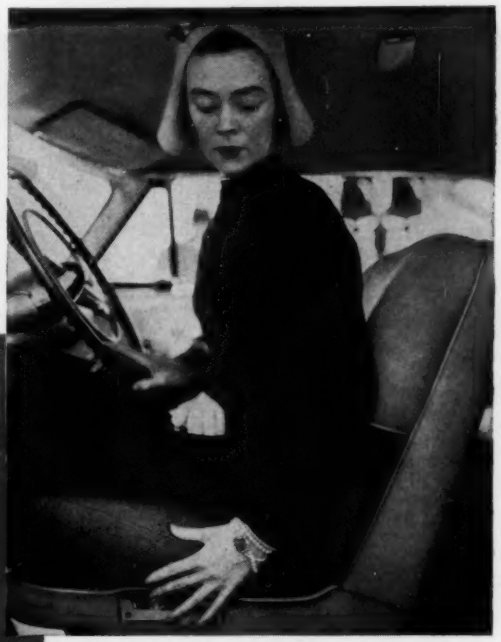
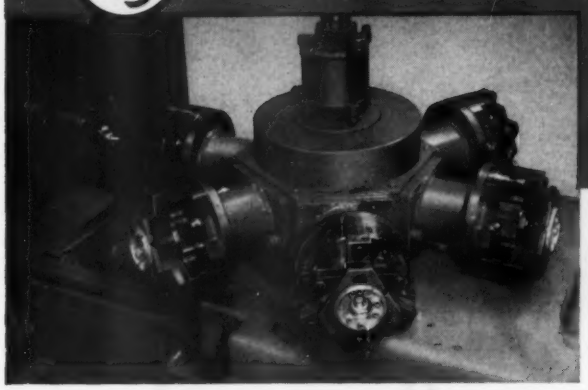
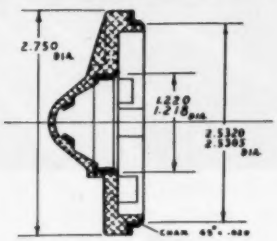


American Bosch manufactures small electric motors used in seat adjuster mechanism for Lincoln-Mercury and other passenger cars. The aluminum housings required are machined at 170 pieces per hour.





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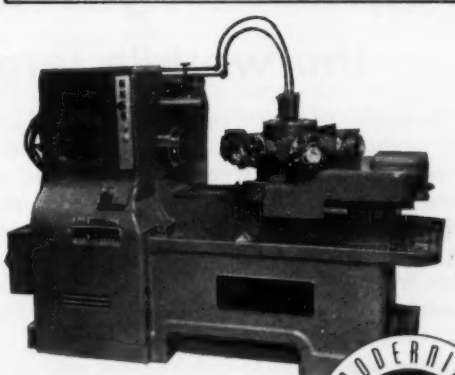
Machine loading time was eliminated, costs lowered, and production greatly increased by the use of air operated chucks on each of the six turret faces. The operator simply inserts the work piece in the open jaws, a stationary air-cylinder (operated by the dog-drum) automatically controlling chuck opening and ejection, and chuck closing. Turret indexing is automatic, rapid and accurate. Idle cutting time is reduced to a minimum . . . the fast, rapid-traverse mechanism moving the turret slide quickly to within 1/64" of feeding position.

You too can benefit from this combination. At no obligation, send today for your copy of the 3-U Bulletin No. 145 . . . or ask our Tool Engineers to submit recommendations based on your own prints or sample parts.



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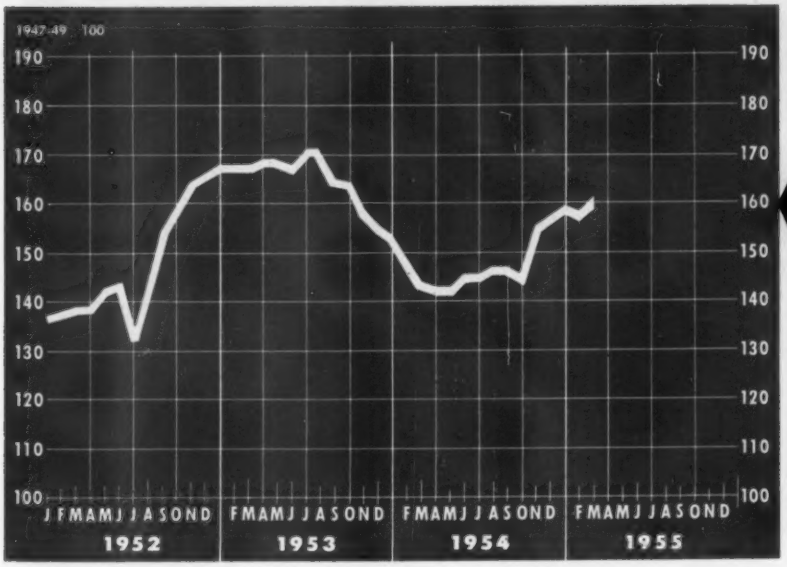
Gaging Metalworking . . .



Production Index

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	MAR '55(*)	FEB '55(p)	JAN '54(r)	FEB '54
Total index	**160**	**158**	**156**	**151**
Machinery	127	123	130	
Electrical Machinery	189	188	163	
Autos	148	152	114	
Other Transportation	275	262	291	
Other Metalworking	128	128	128	

(*) Estimated (p) preliminary (r) revised

AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

Operations at very high point . . .

Metalworking operations were bumped up a bit farther during March. They now are running along within close range (less than 7%) of the post-Korean peak, when a high ratio of production consisted of defense goods.

American Machinist's Production Index, to be specific, is at 160. It never got above 171 in the lush days of 1953.

No one expects the index to advance from the present level. On the other hand, no one thought that it would go up to where it is now when it was down at 148 last October.

Automobile production stays at peak . . .

Automobile assemblies, at or near an all-time high, are spearheading the metalworking production drive that has put the index up 12 points in recent months. Automobile parts companies, as a result of the pressure for shipments from Detroit, are pretty much running double shifts again. This condition exists especially among parts makers serving the Big Three. These companies still are calling back furloughed workers.

Appliance makers say that the first quarter has been much better than the same period a year ago.

The farm implement industry seems to be recovering slowly but steadily from its 1954 low. Sales to dealers and users are up and production schedules have been expanded.

Durable goods demand is up . . .

Industrial machinery business and orders for so-called perishable items for factories have shown greater strength. Machine tool sales have stayed remarkably stable through the January-March period.

Aviation manufacturing is not setting any records. On the other hand, it is one of the stabilizing forces in keeping Metalworking up where it is.

The outlook in aviation is for continuation of production at about the current rate indefinitely.

The railroad freight car industry still is one of the few segments in Metalworking that consistently lags behind. Things are a little better, builders report, but not much.

Third quarter steel orders placed . . .

Steel makers are booked solid through the second quarter on the most-wanted items: sheet, strip, bars. And many steel orders have been placed well into the third quarter by users who are eager to get their requirements on mill books.

The big push for steel is being felt in the smaller companies as well as by the big fellows. All mills now are operating in the 90%-plus bracket.

After an indifferent January, steel warehouses report a steady improvement in sales through February and March. Stocks carried by warehouses are believed to be in good shape.

Drop forge shops report pickup . . .

The drop forge industry has a four-months' backlog, thanks to heavy orders from automobile makers.

Recently, business has come in from heavy machinery builders, farm equipment makers and railroad equipment companies, as well as from Detroit.

Most forge shops, as a result, are operating two shifts, with many on overtime.

The steel castings people, who had a somewhat unhappy time during 1954, have been doing fairly well since early in the final quarter of '54.

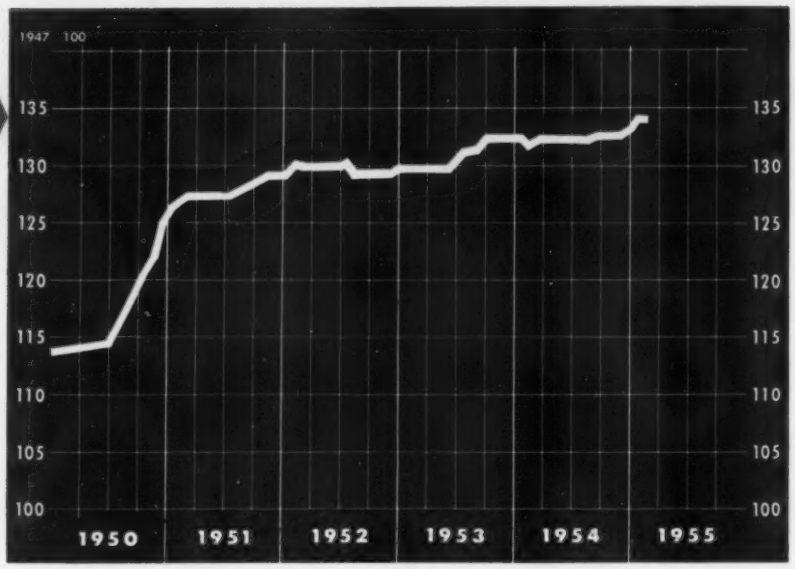
Business has been particularly good from the truck and earth-moving equipment makers.

Gaging Business . . .

Price Index

	MAR '55(*)	FEB '55(p)	JAN '54(r)	FEB '54
Total Index	**134.1**	**134.0**	**133.9**	**132.8**
Metalworking Machinery	**145.8**	**144.3**		**142.0**
Other Machinery exc. Electrical	**138.5**	**138.0**		**137.5**
Electrical Machinery	**132.0**	**132.0**		**132.0**
Fabricated Metal Metal Products	**130.4**	**130.6**		**129.1**

(*) Estimated (p) preliminary (r) revised



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

Output of civilian goods smashes records . . .

The volume of civilian goods now being produced is at a record height. This amazing performance is as unexpected as it is gratifying.

It's true that industrial production in midsummer of 1953 was slightly above today's figure. But defense items of all kinds made up a sizable portion of the total then. Today, that is no longer true.

The business upswing continued in March at an even stronger pace than in preceding months.

Industrial output got up to 135 on the Federal Reserve Board's index (1947-1949 = 100).

Industrial prosperity spreads out . . .

It has been popular to point to three sources as being responsible for holding the economy up to its current prosperous level: Autos, construction, and steel.

Industrial activity recently has spread out to embrace many more industries. New high marks have been chalked up in such diverse lines as chemicals, petroleum, paper, stone, furniture and leather.

The belief is growing that if automobiles, construction and steel should dip a bit, the slack may well be taken up by these other industries.

Biggest Easter ever for retail sales . . .

Retail trade is booming. This is the biggest Easter season ever for retail stores.

In the first quarter of '55, retail sales averaged about $15 billion a month. That is 3% above the previous all-time peak set in the final quarter of last year.

When sales are added up for the six weeks prior to Easter this year, they are likely to beat 1954 by 10%.

People plan to spend freely . . .

Families intend to buy more consumer durable goods (such as automobiles and refrigerators) this year than last, the recent consumer survey of the Michigan Research Center shows.

Another finding of the survey: Increasing numbers of people expect good times and anticipate gains in their own incomes. When people feel this way, previous findings reveal that business soared.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49 = 100)*	140.9	140.1	120.6
Steel ingot production (thousand tons)	2,258	2,262	1,648
Electric power output (million Kilowatt hours)	9,907	9,814	8,491
Production of automobiles and trucks	216,777	212,776	149,586
Engineering construction awards (*Eng. News-Record*, millions)	$335.8	$544.8	$329.5

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	229	176	197
Vacuum cleaners sales (thousands of units)	217	238	191
Washers sales (thousands of units)	265	308	197
Household electric ranges sales (thousands of units)	85	79	74
Radio production (thousands of units)	1,262	1,071	1,101
Television production (thousands of units)	833	859	450
Gear sales index (1947-49 = 100)	182.2	116.7	194.0
Foundry equipment new orders index (shipments, 1947-49 = 100)	113.9	61.4	494.3

*Seasonally adjusted

a Natural when it comes to Passes

Typical Monarch Roll Turning Story

12¼ hrs.

vs

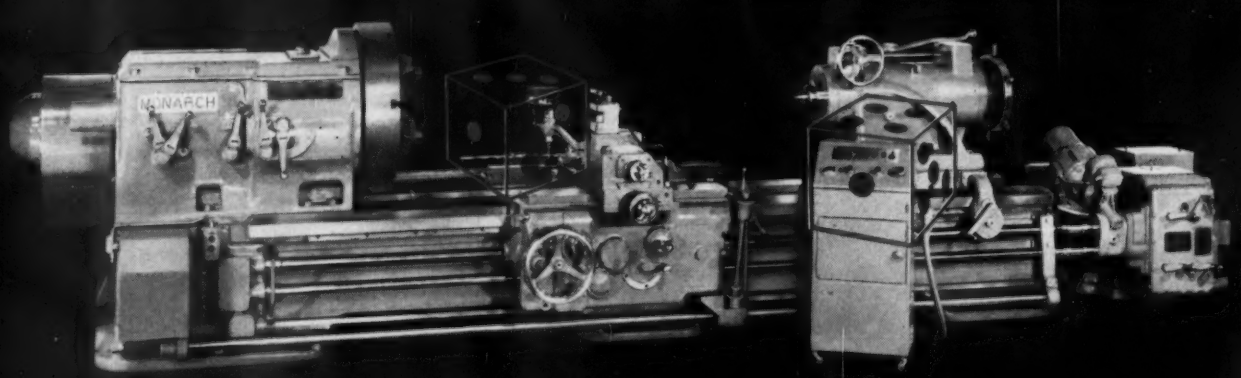
Old 31 hrs.

Why roll it the hard way when faster turning time is what comes naturally to our Heavy Duty Roll-Turner with Monarch-Keller controls? Every job report we ever got from a user confirms it! Consider this one:

Part is a 10″ diameter roll having 30″ body length and made of grain iron with a hardness of 60-65 scleroscope. It has 13 half-round passes ranging from 1⅝″ to 1 13/16″ diameter. Monarch rough turning time is 9¼ hrs.; finish turning time, 3 hours.—*total time, 12¼ hrs.*

For comparison, the most competent roll turner in the user's plant tried to compete on an old-style roll lathe. Working all-out, and much harder than the other operator, he still required 24 hrs. roughing time; 7 hrs. finishing time—*a total of 31 hrs.*

Why handicap yourself with costly old methods any longer? It's a sure bet that we can save time and money for you. Write for the complete story—illustrated Booklet #1302.



"SAVE IN MANY WAYS With The Monarch Heavy Duty Roll-Turner"

1. On all types of rolls which lend themselves to this method of turning, floor to floor turning time averages from ⅓ to ¼ of the former time.

2. With standard carbide turning tools with regular tool grinds, hundreds of form tools required by conventional methods are not needed. Tools can be changed with no sacrifice of contour accuracy.

3. With template controlled contour forming, matching rolls in pairs is unnecessary. Each roll turned from any given template is identical. One of pair of rolls can be redressed or new roll turned without matching the other.

4. When redressing a roll, the operator may quickly check the point of greatest wear with the corresponding point on the template after which he can be certain that the entire roll will clean up on the first pass.

5. The same template is used for both the rough and finish passes. Thus finishing immediately follows roughing with no set-up change other than the required tool change.

6. Operator cannot modify roll shape. As the template form is dimensionally the same as forms to be turned on the roll, their longitudinal placement and relationship are sure to be accurate.

Monarch

ACCURACY • ECONOMY • LONG LIFE

TURNING MACHINES

FOR A GOOD TURN FASTER . . . TURN TO MONARCH

THE MONARCH MACHINE TOOL COMPANY
Sidney, Ohio

Sharp Clean Cuts EVERY TIME

Many thicknesses and sizes of metal are cut on this Steelweld Shear every day. Thanks to Steelweld's exclusive MICRO-SET knife adjustment, it is easy to set the knife clearance to the exact amount which will produce the best cut for every plate run through the machine.

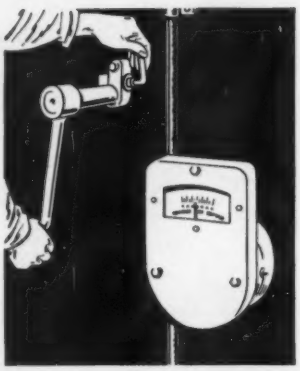
If desired, the knife clearance can be set for an average thickness and all plates cut without changing the clearance. This procedure is used with most shears because to change knife clearance on them is a tedious, difficult operation which usually puts a machine out of service for hours.

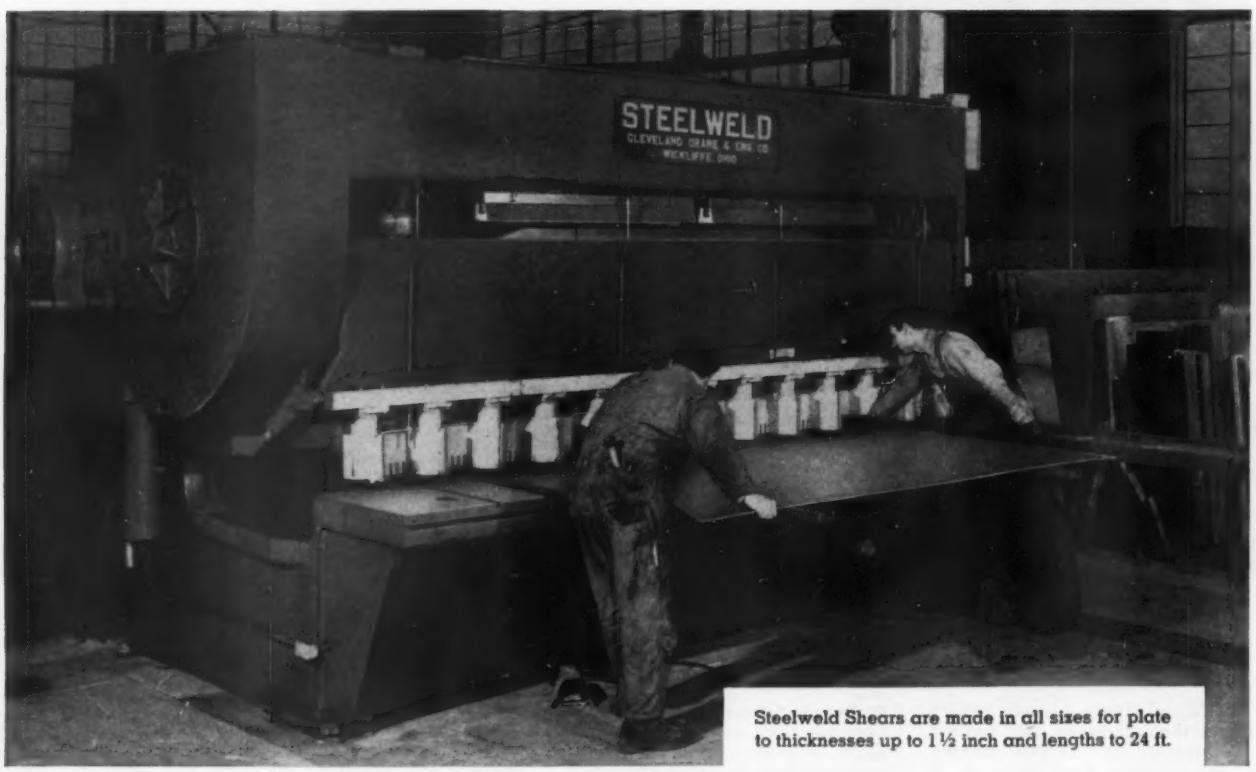
In contrast, knife adjustment on Steelwelds is made in a few seconds. It's simply a matter of turning a crank until an indicator points to the figure representing the thickness of plate being cut. No bolts to loosen; no parts to move. There is no need for using "average" knife settings.

The clutch and brake unit is another outstanding feature of Steelweld Shears. As it is air-operated, it is quick, snappy in action. Its low-inertia design assures cool operation, even after long continuous production runs, because energy to be dissipated is minimized and working pressure necessary on clutch and brake facings is greatly reduced.

The many features of Steelweld Shears make it worth your while to get all the facts.

Because of MICRO-SET Knife Adjustment





Steelweld Shears are made in all sizes for plate to thicknesses up to 1½ inch and lengths to 24 ft.

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CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

1446 East 282 St., Wickliffe, Ohio

STEELWELD PIVOTED BLADE SHEARS

American Machinist

MAGAZINE OF METALWORKING PRODUCTION * ESTABLISHED 1877

Mechanization Creates Jobs

A lot of warning fingers are being wagged about the possible harmful effects stemming from the much-publicized second industrial revolution, now well along. Most of the worry has to do with the feeling that the speed-up of mechanization is bound to breed unemployment.

The best way to allay this fear is to examine the facts. And the facts, we are happy to say, give little if any nourishment to this fear. The facts have been brought together in a pamphlet recently issued by the Council for Technological Advancement, an offshoot of the Machinery & Allied Products Institute.

Despite the fact that a vast amount of machine power has supplanted hand power in this country in recent years, employment in U S manufacturing industries has grown significantly rather than shrunk. The number of workers today, 17 million in all, is 70% greater than in 1939, when there were only 10 million. The population increased a mere 22% in the same time.

In the face of a tremendous upsurge in productivity per worker, you might expect that the proportion of the total labor force employed in manufacture would have dropped off. But the fact is that the opposite is true.

In 1953, about one out of every four workers had jobs in the manufacturing industries. That was equal to the World War II peak. It is impressively ahead of the ratio in 1940, just before we went into the war, or in 1929.

The gain in jobs has been especially marked in the machinery field. Employment in electrical machinery has tripled since 1939 (being well over 1 million now.) You will find essentially the same story in the industries making machinery other than electrical.

Take the measuring and control instruments business. It thrives on automation. Witness its employment story. It has attained sufficient stature that the federal government now lists it separately in reporting production and employment. It has 335,000 workers at present. That is about where the automobile industry was in the middle 1930's.

This recital of facts could go on and on. For figures are plentiful in support of the thesis that today there are more jobs by far in manufacturing industries than ever before in peacetime.

The statistics provide overwhelming evidence that there is an expanding market for the goods produced. This expansion of the consumer market never would have occurred except for the beneficial effects of technology.

Mechanical power added enormously to the worker's output. His increased output made it possible for management to pay him more money. With more money in his pocket, he bought more goods.

More than that, technological advances have helped reduce production costs. Lower prices and a widening market often have been the result. Product improvements, making for much greater buyer acceptance, also have been stimulated by better technology.

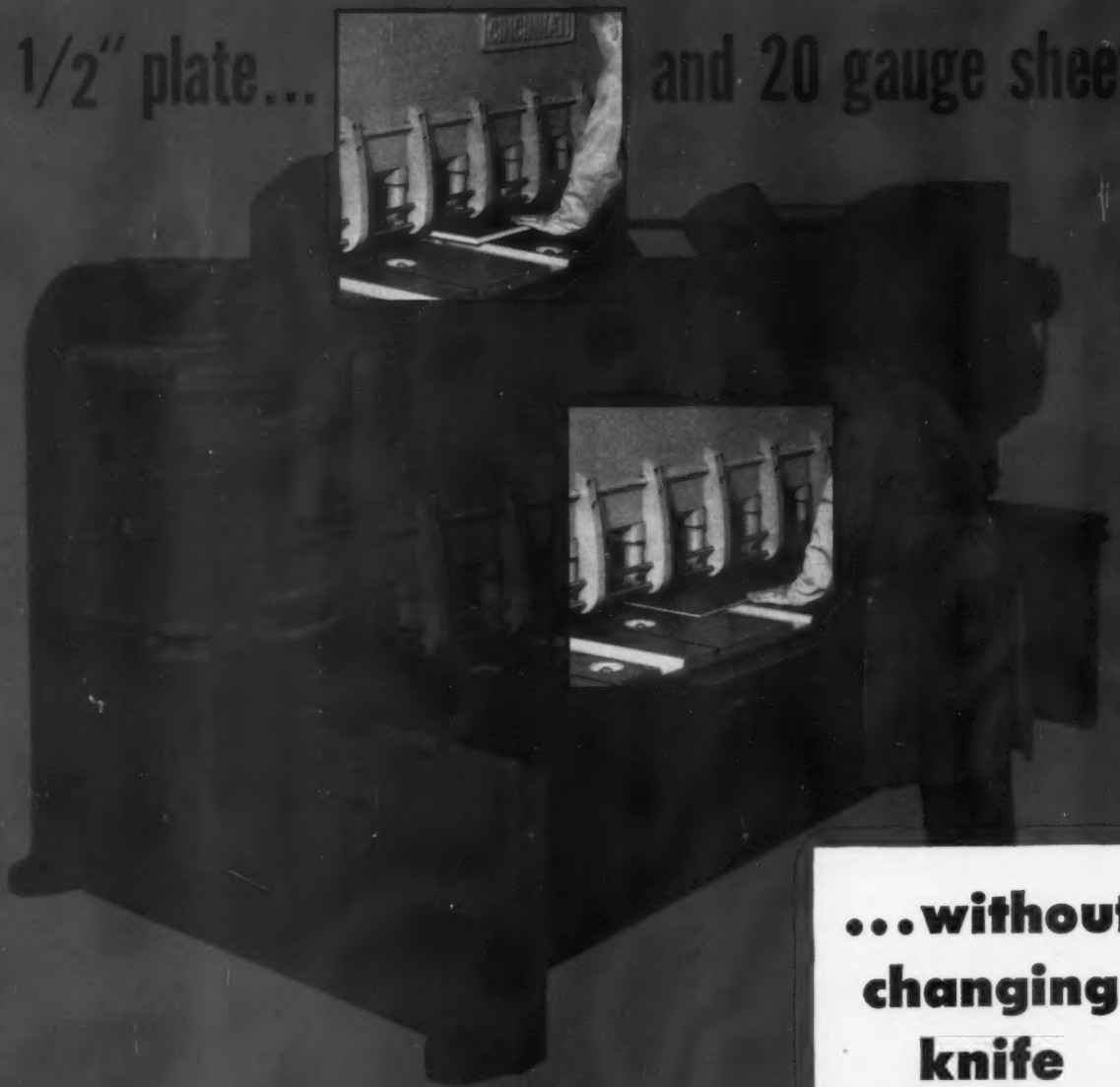
There is not space here to discuss the notable gains in employment in the trade and service industries resulting from the relentless and never-ending movement toward mechanizing every possible production process. It is enough to point out the abundant evidence at hand in the manufacturing industries themselves to answer decisively those who are genuinely worried about the effect of automation on employment, or who, for selfish purposes, would like to leave a bad impression in the minds of the American people.

The truth is that if you view the over-all benefits to the economy as a whole, mechanization creates rather than destroys jobs.

Burnham Finney

CINCINNATI accurately shears

1/2" plate... and 20 gauge sheets



...without changing knife clearance

. . . You do not change knife clearance for successful shearing of different thicknesses on a Cincinnati. Just set the clearance for the thinnest material and shear all thicknesses up to capacity. Thousands of Cincinnati Shears are used continuously in this manner. This practical method prevents accidental damage — saves time. Remember, changing knife clearance interrupts production.

Sharp knives are a necessity for satisfactory shearing, especially on very light gauges. Remember, changing knife clearance does not sharpen dull knives. We suggest you write for data sheet on knife life.

Write for Catalog S-6 . . . describing Cincinnati Shears

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

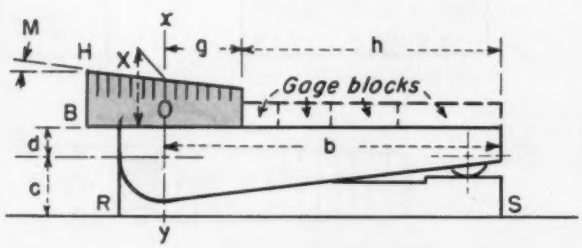
CINCINNATI

American Machinist

Problems in metrology

Ingenious solutions to awkward measuring problems, including special gages for internal and external tapers, and unusual uses of sine bars

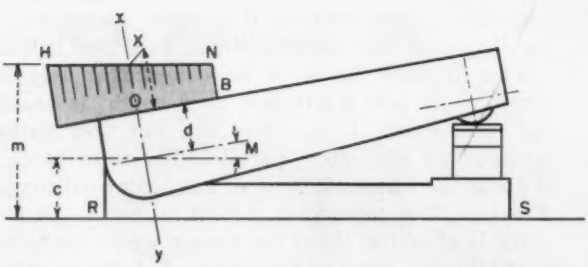
CH MINAIRE, chief metrologist
ST ETIENNE NATIONAL ARMORY, FRANCE



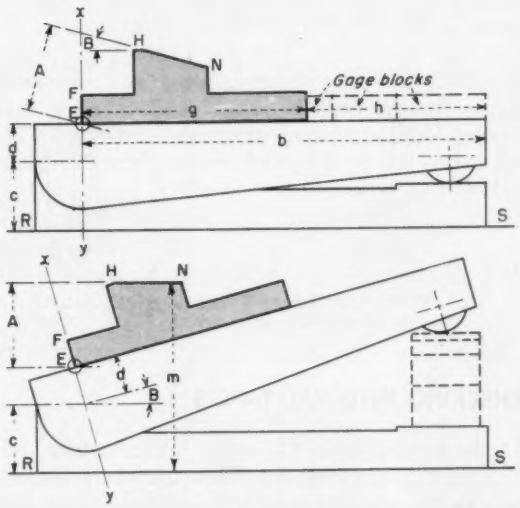
LINEAR MEASUREMENTS ON A SINE-BAR FIXTURE

Sine bars are generally used for measuring angles but, in some cases, may also be used for linear measurements. For example, to measure the height X at the zero mark on the block B which has a taper of 0.0025 in. per in. Dimensions b, c, and d of the sine-bar fixture are known.

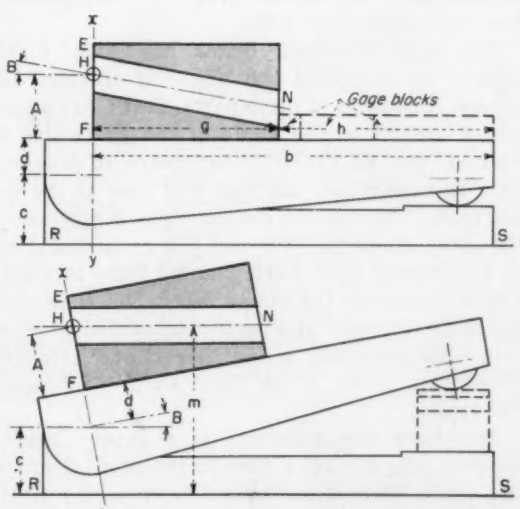
Align the zero mark of B (above) with the continuation of the axis xy by means of gage blocks such that $h=b-g$. The length g can easily be measured within ± 0.0005 in., and the effect of this much tolerance is negligible because 0.0005 x 0.0025 is only 0.0000125 in. in the height.



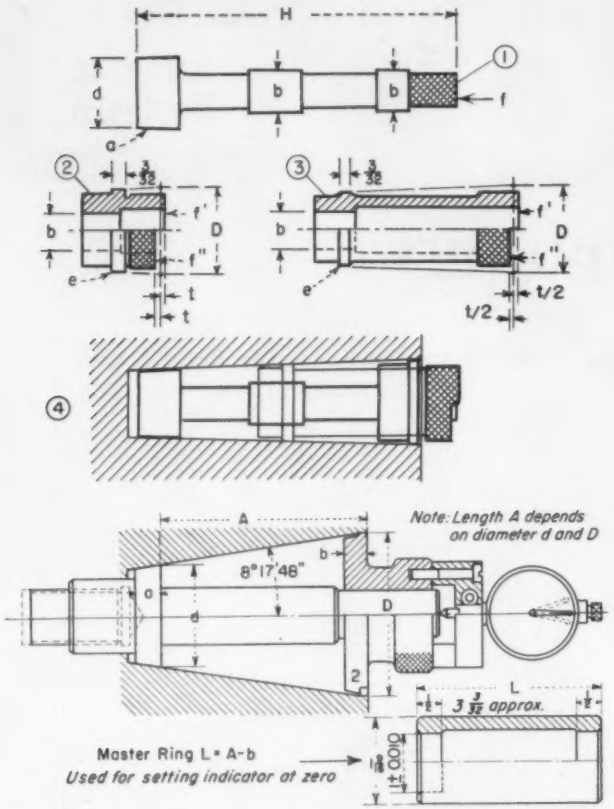
Tip the sine fixture to the angle M (tangent 0.0025 $=0°8'\ 36''$) to bring the face HN parallel to the base RS. Measure the height m. Then the height of the zero mark $x=\dfrac{m-c}{\cos M}-d$



To measure dimension A; *dimensions b, c, and d of sine fixture being known. Align EF with axis xy by means of gage blocks such that h=b–g. Tilt sine bar to angle B to bring face HN parallel to base RS. Measure m. Then* $A=m-(d\times \cos B)-c$



To measure dimension A; *b, c, and d being known. Align face EF with xy axis of sine bar, using gage blocks such that h=b–g. Tilt sine bar to angle B to bring axis HN parallel to base RS. Measure m. Then* $A=\dfrac{m-c}{\cos B}-d$



CHECKING INTERNAL TAPERS

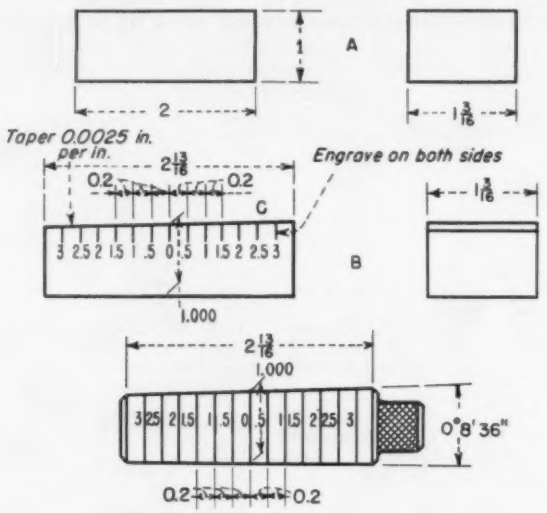
In the case of taper fits, as on lathe centers and tool shanks, it is essential that the angle of the male taper be exactly equal of that of the female taper. Checking the angle of the male taper is fairly easy.

Certain measuring machines are available for exact measuring of the angle of inside tapers, but such measurements are always lengthy and, consequentially, expensive. They are not practicable for high-production use.

The gage described below has given excellent results for checking the angle of internal Morse tapers. It consists of three parts. Part *1* has a tapered end *a* ground to the angle of the particular taper desired, less 10′. This 10′ difference is provided so that, in most cases, the plug will bear at the end of the taper. Two cylindrical bearings *b* are ground to the same diameter. The end *f* is ground and serves as a reference face. Parts *2* and *3* have tapered collars *e* ground to the Morse taper. Dia *D* is equal to the large diameter of a perfect truncated cone whose small diameter has a diameter *d* and a height *H*. Dimension *t* and t^2 are fixed by the tolerance on the taper.

To check the accuracy of a taper, insert the tapered plug of part *1* close to the small diameter of the work. Then place part *2* over part *1* near the large diameter of the work. Part *2* will enter more or less, according as the angle is large or small. The angle is correct if faces *f′* and *f″* are equidistant from the face *f* of part *1*. To check at the center of the taper, repeat the operation with part *3*, and see if face *f* is equally spaced between faces *f′* and *f″*. If the work checks at both points the angle can be assumed to be correct.

For milling machine tapers which have a much larger angle, and on which the end movement of parts *2* and *3* as a function of angular variations would be very small, the gage shown in the second illustration may be used. The principle is the same as in the first gage, but a dial indicator, set to a master ring, shows the end movement of part *2* resulting from variations in the angle. According as the angle is greater or smaller, the indicator pointer will move above or below the zero setting.



FLATNESS CHECKING BLOCKS

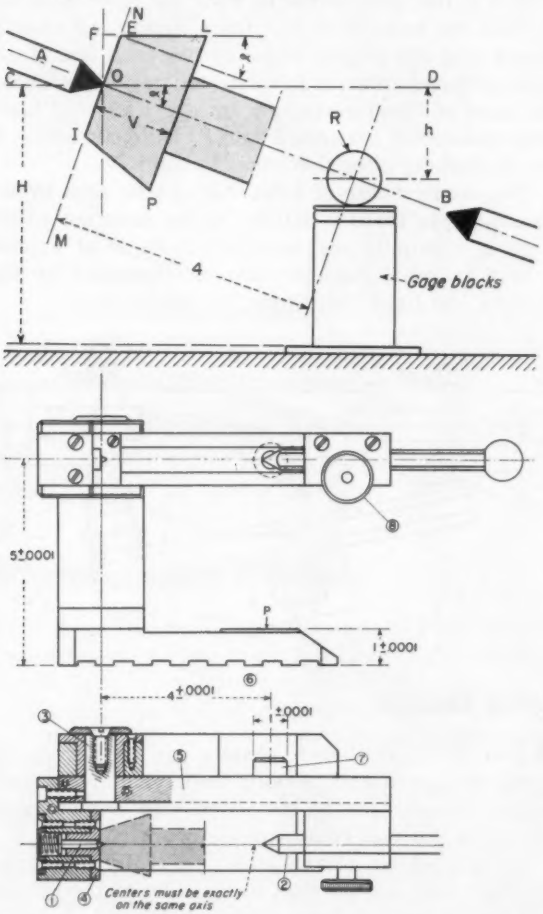
To check the flatness of a surface, the conventional method is to support a straightedge on two gage blocks of equal size, then slide other gage blocks under it. The difference in height between the supporting blocks and the various gage-block combinations required at different points shows the amount by which the surface is concave or convex at those points. If possible, the straightedge should be supported at its Airy points, that is, the distance between the supports should be equal to 0.56 of the length.

However, considering the risk of wear on the blocks, and the time it takes to stack the various gage-block combinations, it is more economical to use the set of three special blocks described below.

Two of these blocks *A* have approximately the same length and width but their height is exactly the same — say 1 in. — and the top and bottom surfaces are absolutely parallel. The third block *B* is about the same width as *A*, but somewhat longer. The face *C* is tapered at 0.0025 in. per in. A zero mark is placed at about the center, where the height is exactly the same as the blocks *A*. Division marks are made, each side of zero, at intervals of 0.20 in. For convenience, it is advisable to place these marks on both sides of the block. The difference in height between any two consecutive marks is exactly 0.0005 in.

To check a surface, place the two blocks *A* upon it, using these to support a straightedge at its Airy points. Then advance the taper block under the scale at the desired checking points. At the point of contact with the scale, the graduations before or after zero will show in units of 0.0005 in. how much that point is concave or convex. Knowing the distance between consecutive graduations, it is easy to estimate fractions of a unit.

The better to localize the points to be checked, a tapered plug may be substituted for the wedge-block *B*. This has a diameter at the middle the same as the height of blocks *A*, and a taper of 0.0025 in. per in., or a half-angle of 0°4′18″.



CHECKING THE FRUSTUM OF A CONE

To check the frustum of a cone it is necessary to verify the straightness of the faces, the accuracy of the circular sections, the value of the angle, and the diameters of the ends. These four checks can be made by the gage illustrated.

The priciple involved is shown in the accompanying layout. The axis of the cone coincides with the centerline of the centers *A* and *B* of the hinged workholder, and the face of the small end of the cone corresponds to the axis *O* of the workholder hinge. By placing a disk *R* on the axis *AB*, 4 in. from *MN* and at a distance *h* from *CD*, the face *EL* of the cone will be brought parallel to the base of the setup. Measure the distance *OF*.

Then $\frac{h}{4} = \sin a$, and $EI = \frac{2 \times OF}{\cos a}$

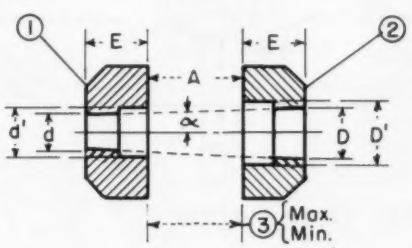
The diameter of the large end can be obtained by measuring the vertical height *V* of the cone. Then $LP = EI + 2\,V \times \tan a$.

To check circularity at any point, place the tip of a dial indicator in contact with the face *EL* and rotate the work on its axis. If all points of this face are equidistant from the base, the face is straight.

A practical gage employing these principles is shown in the accompanying illustration. The cone to be measured is held between centers *1* and *2* whose axis is in line and square with that of the pin *3*. The small end of the work rests on the face of the bushing *4* located on the axis of *3* around which the workholder *5* can pivot.

Pivot the workholder to bring the top edge of the work parallel to the base *6* by inserting gage blocks between disks *7* and pad *P* which has been ground perfectly flat and parallel to the base. The axis of the disk *7* is in the same plane as the axes of the centers and the pin *3*, and at exactly 4 in. from the latter.

The center *1* is spring-loaded. Center *2* is held in the desired position by the nut *B*.

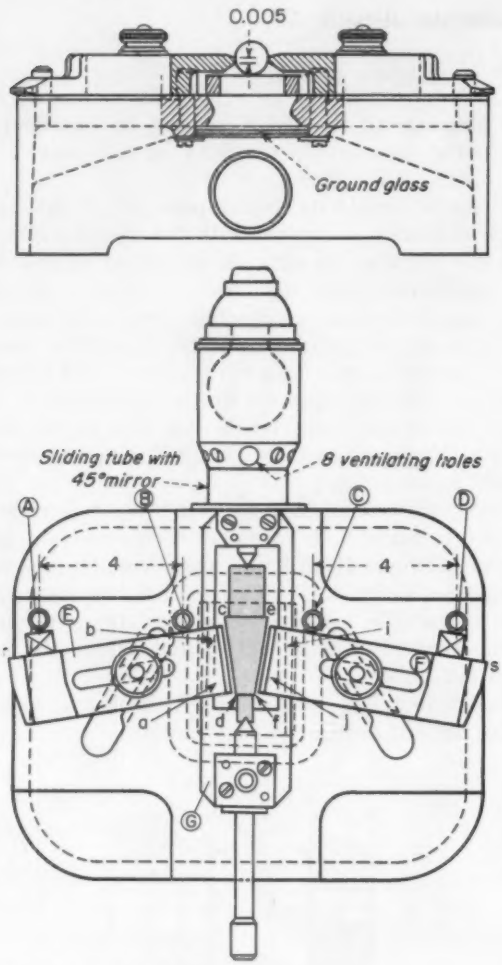


OUTSIDE TAPER GAGE

When the number of pieces to be checked justifies making special gages, as for taper shanks of tools, or for parts that do not have accurate centers, the gage shown here can be employed. It consists of two rings *1* and *2*, having an angle *a* the same as that of the taper to be checked, and the diameters *D* and *d* the same as the corresponding diameters on the work. The inner ends are counterbored at D^1 and d^1 to reduce the bearing areas because the thickness *E* is necessary for stiffness. Faces *A* must be absolutely perpendicular to the axis of the taper. Two flat plugs *3*, whose difference in length is the same as the tolerance on the taper, control the distance between the rings when these are positioned on the work.

To use the gage, place ring *2* on the large diameter of the work, and ring *1* on the small diameter. By means of the Go and Not Go plugs, check that the spacing of the rings is within the limits allowed by the tolerance on the taper. If the distance between rings allows the Not Go plug to enter, the angle is too small; it does not allow the Go gage to enter, the angle is too big.

PLEASE TURN PAGE . . .



LIGHT LINE TAPER CHECKER

This fixture consists of a base *H* carrying four chrome-plated buttons, *A*, *B*, *C*, *D*, having exactly equal diameters and set exactly in line. For ease in making the necessary calculations, make the center distance between each pair exactly 4 in.

The workpiece is illuminated by a light bulb whose light is reflected by a 45° mirror through a ground glass. The lamp housing slides in and out to illuminate any particular area of the glass.

Two blocks *E* and *F* have the corners *a*, *b*, *r*, and *j*, *i*, *s* exactly at right angles and are held in gaging position by bolts and nuts. The gaging edges are chrome plated, and are chamfered to leave a 0.005-in. land centered on the axis on the workholding centers. Upper chamfer is dull to prevent reflection.

A workholder *G* carries a pair of centers and can be adjusted to suit the work to be measured.

To use the gage, space the blocks *E* and *F* at the approximate diameter of the work, resting them on buttons *B* and *C*, and separated from buttons *A* and *D* by gage blocks with a value of $4 \times \sin \frac{a}{2}$

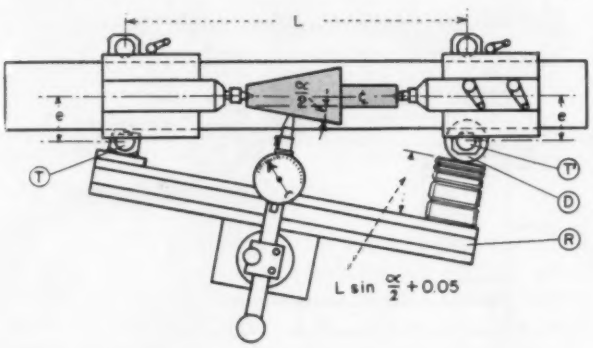
Lock the blocks *E* and *F*. Place the work between centers on workholder *G* and position this to obtain a parallel line of light just visible between the face *ab* of the block *E* and the edge *cd* of the taper. Check to see whether the line of light between the edge of the taper and the face *ij* of block *F* is parallel. If not, it can be adjusted by increasing or reducing the height of the gage block between *F* and *D*.

Suppose, for example, that x = the thickness of the gage block corresponding to the angle $\frac{a}{2}$, and x^1 is the thickness corresponding to the new angle *B* necessary to obtain parallelism between *ef* and *ij*.

Then $\sin B = \frac{x^1}{4}$, and the taper angle is $\frac{a}{2} + B$

If it is not practicable to hold the spacing of the buttons to exactly 4 in., their diameters exactly equal, and the gaging edges of blocks *E* and *F* exactly perpendicular, it is relatively easy to establish the sum of these variations by a cylinder or taper gage positioned between *E* and *F*. Note correction to be applied for precision measurement.

The smallest line of light that can be seen by the naked eye is about 0.0001 in. so the accuracy of the gage is within 10 sec on the half-angle of a piece 1 3/16 in. long. Accuracy can be increased by observing the light line through a microscope.



TAPER CHECKER

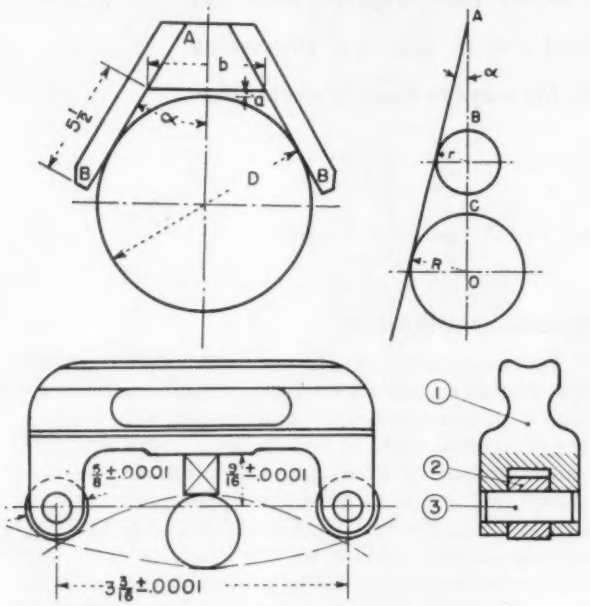
A pair of 20-in. bench centers can be set up for checking tapers, and permits inspection of the half-angle, straightness of the sides, and out-of-round condition without removing the work.

The hold-down bolt holes are carefully re-reamed so their axes are parallel to the axis of the centers —*e* equals *e*—and their center distance *L* is measured accurately. A straightedge *R*, carefully trued up, pivots on a pin in the hole *T*. A disk *D* is centered in hole T^1 and is of such a diameter that when a 0.05-in. gage block is placed between it and the straightedge, the outside of the latter will be parallel to the axis of the centers.

To check a taper angle *a*, insert gage blocks between the disk and the straightedge to a height of *L* $\times$ $\sin \frac{a}{2}$ + 0.05 in. A dial indicator on a suitable support is set at the same height as the centers and slid along the straightedge with its tip in contact with the face of the taper. Movement of the indicator pointer will show any errors in taper angle or straightness of the face. Rotating the work on its

own axis will show up any out-of-round condition.

Absence of taper and straightness of face can be checked in the same manner by placing just the 0.05-in. block between the disk and the straightedge. To check taper reamers with helical teeth, set straightedge to desired angle, and move the indicator into contact with one end of the reamer. Rotate the work and note the point on the indicator dial to which the pointer moves in a positive direction. Slide the indicator to the other end of the reamer, rotate the work and check whether the pointer moves to exactly the same position as at the other end.



CALIPERS FOR LARGE DIAMETERS

Exact measurement of the diameter of large circles having an arc of more than 180° is quite difficult because of lack of sensitivity and the chance of expansion presented by the use of relatively heavy or bulky micrometers. These difficulties are increased when arc is less than 180°.

The type of snap gage shown herewith will be found useful in such cases. It consists of a block *A* in the form of a trapezoid, to which are fixed two arms *B* with accurately ground and flat measuring faces.

To use, place the two arms in contact with the work, and measure distance *a* by a gage block. Angle can be established so variations in dimensions *a* translate directly into differences in dia.

In Fig. 2, $AB = \frac{r}{\sin a} - r$, $AC = \frac{R}{\sin a} - R$,

from which, $AC - AB = \frac{R - R \sin a - (r - \sin a)}{\sin a} =$

$$\frac{(R - r)\ (1 - \sin a)}{\sin a}$$

$AC - AB = \frac{(D - d)\ (1 - \sin a)}{2 \sin a}$. If $AC - AB$ has been made equal to $D - d$, then $D - d =$

$\frac{(D - d)\ 1 - \sin a}{2 \sin a}$, from which $\sin a = \frac{1}{3} = 19°$

It is easy to increase or reduce the accuracy to the extent desired by modifying angle *a*. Where the work to be checked varies by 0.10 in., a dial indicator can be installed in *A* on the exact centerline. The gage is set to a master cylinder of known diameter where, knowing *b* and *a*, *D* is determined according to the measured dimension *a*.

A gage with the angle $a = 30°$ and an effective length *B* of 5½ in. will measure diameters from 5⅛ to 13 in. Larger diameters can be covered by increasing the distance *b* and the 5½-in. dimension.

Another gage, shown in Fig 3, is somewhat less accurate but, if made to the dimensions given, will measure both inside and outside diameters of circles of any size, provided the chord length is at least 3⅜ in. for OD's, or 4 in. for ID's.

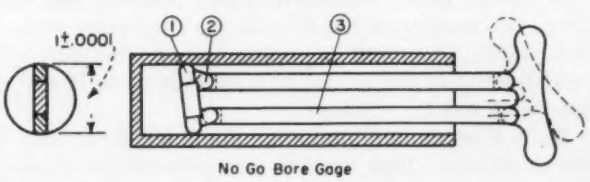
It consists of a yoke *1*, with two accurately fitted pins *3* located at exactly the same distance (9/16 in.) from the reference face of the yoke, and 3 3/16 in. apart. Rollers *2* are identical in dia (⅝ in.) and rotate on the pins without appreciable play.

To use this gage, place it on the work so both rollers are in contact, and measure the distance *T* by means of gage blocks, a plug gage, or a combination of both. If *a* is the radius of the rollers; *b*, half the distance between roller centers (1 19/32 in.); and *c* is the difference from the center of the rollers to the reference face, then *D* is found by:

$D = \frac{b^2 - a^2 + (c - T)^2}{a + c - T}$ for convex arcs. For concave arcs, the formula is:

$D = \frac{b^2 - a^2 + (T - c)^2}{T - a - c}$

It is difficult to establish the dimensions 9/16, ⅝, and 3 3/16 in. exactly, but they can be held to less than 0.0001 in., which will give satisfactory results. Note that accuracy varies inversely as the diameter. If diameters are extremely large, make 3 3/16- or 9/16-in. dimensions larger.



No Go Bore Gage

NO GO BORE GAGE

This ingenious tool is easily made and serves to check whether all parts of a deep bore are below maximum size. It consists of two carbide contacts *1* brazed to the yoke *2*, and ground to the maximum limit, in this case, 1 ± 0.0001 in. The yoke can be tilted by the handle *4* and links *3* to enter it to the required depth in the bore.

To make the check, manipulate the handle to cause the contacts to engage the walls of the hole. In straightening up, they tend to take a position perpendicular to the axis of the work. If the size is right, the contacts will not be able to straighten completely and will always bind in the hole.

Cope Talks on Draw Dies ... XXVI

Solve special-shell problems with proved die design methods

A shell with corrugations, two levels, or pockets, as the case may be, does not need "tricky" die design for solution. As pointed out in the two preceding installments on special shells, and here too, look for ways to handle each operation according to the rules expounded

STANLEY R COPE, president, ACME SCHOOL OF DIE DESIGN ENGINEERING, SOUTH BEND 1, IND

Corrugations are formed in the sides of drawn shells, either in ordinary rolling machines or in dies equipped with hardened balls, as shown in Fig 1. If the depressions are the same size and shape, and are spaced uniformly around the body of the shell, as shown in Fig 2, they can be formed by rolling. If the depressions are of a different size and shape, or if they are not of the same length, as shown in Fig 3, it is necessary to form them in a die.

Operation of the die shown in Fig 1 is: the shell is placed in nest *A* and rests on pressure pad *B*. Pad *B* is normally held flush with the top of ball retainer *C* by pin *D*. When the press is tripped, punch *E* enters the shell and forces it into the die, where balls *F* form the depressions. The balls are located in the retainer, at two levels, to form depressions of different lengths. They are backed by springs *G*.

When the punch returns to its top position, pad *B* ejects the shell from the die and the shell rises with the punch. The shell is stripped from the punch near the top of the stroke by knockout plate *H* and knockout rod *I*.

Balls *F* serve two purposes: First, while forming the depression, they revolve and prevent the shell from becoming scratched and scored. To form depressions in the sides of a shell involves stretching. Solid dies would dig into the metal and cause the die to load badly. Second, the balls offer no resistance to ejection, they back up into their holes slightly.

The holes that contain the balls should be drilled at 15° to the vertical centerline of the die. They should be deep enough to permit the balls to protrude sufficiently into the large hole in the ball retainer to form depressions of the desired depths. The holes must not be drilled clear through the retainer. The retainer should be made of hardened and ground tool steel.

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SPECIAL DRAWING DIES

Stampings with two levels, such as the automobile-engine oil pan shown in Fig 4, and other stampings with shoulders, such as shown in Figs 5 and 6, are ordinarily made in two drawing operations. The usual method of producing stampings of the type shown in Fig 4 is to draw the upper portion of the pan as far as the first level in the first die. The previously drawn portion of the shell is then held tightly in the second die to protect it against being distorted while the remainder, or lower portion, of the shell is being drawn. See Fig 7.

If a double-action press equipped with two independent hydro-pneumatic cushions is available, these two operations can be performed in one die, as shown in Fig 8. Three views of the die are shown. In the first view the blankholder has descended and is shown gripping the blank. Both pressure pads are flush with the top of the die. In the second view the shell is shown drawn to the first level. The pressure pad at the left has descended part way into the die, but the pressure pad at the right remains stationary during this operation. Further descent of the slide causes the pressure pad at the right to be forced down and draw the remainder of the shell as shown in the third view.

Round shells of the type shown in Fig 5, can be blanked, drawn and redrawn, complete in one stroke, in a single-action press, provided that the press is equipped with a double-action pressure attachment designed to operate two draw-rings independently. A die for performing these operations is shown in Fig 9. With this die the blank is cut between rings *A* and *B* and is drawn into the first-operation shell in the same manner as with an ordinary combination die. During this action draw ring *C* descends in the usual manner, while collar *D* remains stationary.

When the first-operation shell has been drawn

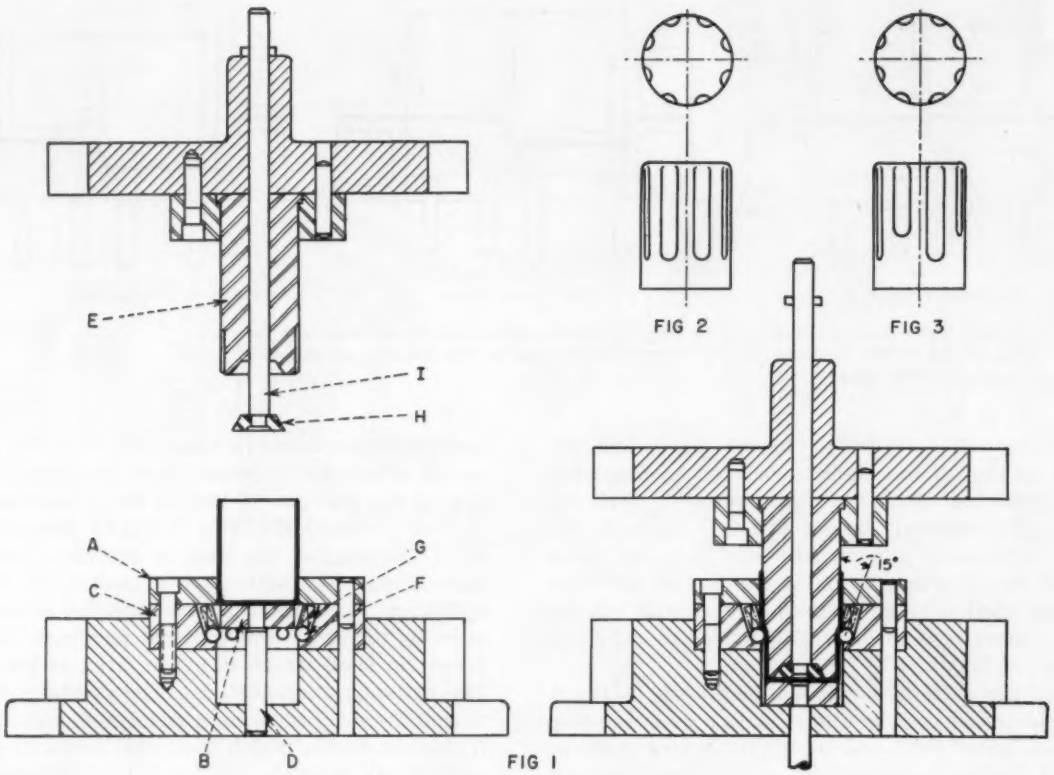


FIG 1

FIG 2

FIG 3

FIGS 1 to 3 ... Corrugations in the side of a shell, if of different sizes, lengths or spacing must be formed in a die. The corrugating balls in the die, Fig. 1, are located in a retainer at the necessary levels, and are backed up by springs to offer no resistance to ejection of the finished shell

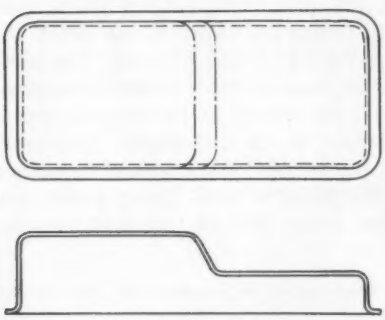


FIG 4

FIGS 4 to 7 ... Two-level and shouldered stampings are ordinarily made in two operations. However, accessory press equipment like hydro-pneumatic cushions, a double-action pressure attachment, etc, may make a single draw possible

FIG 5

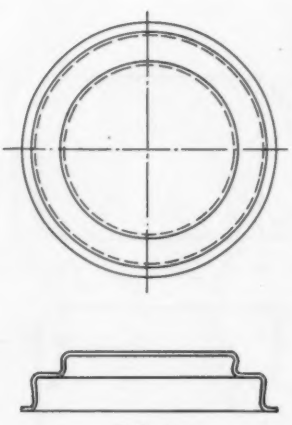


FIG 6

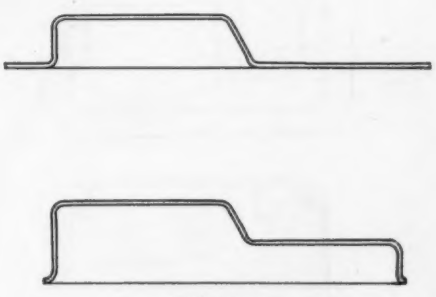


FIG 7

PLEASE TURN PAGE . . .

Cope talks on draw dies . . . XXVI . . . continued

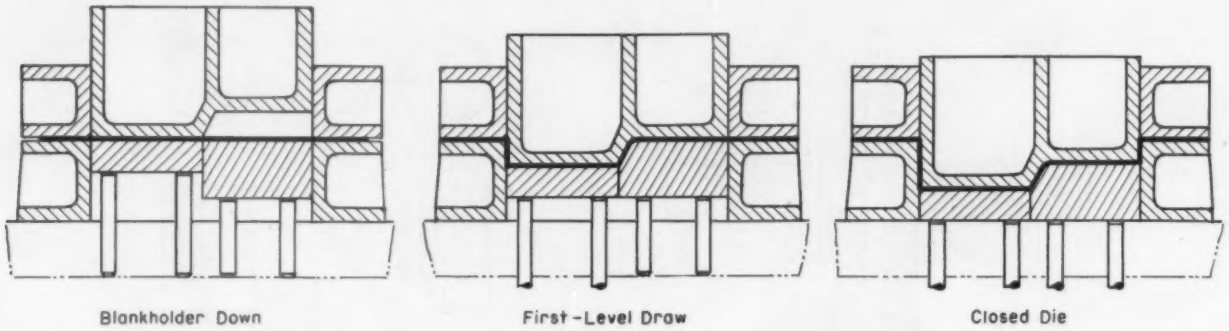


FIG 8 . . . Oil pan is drawn in one operation, because the double action press is equipped with two cushions. These are set so that the first level and then the second level of the stamping are drawn at appropriate portions of the stroke

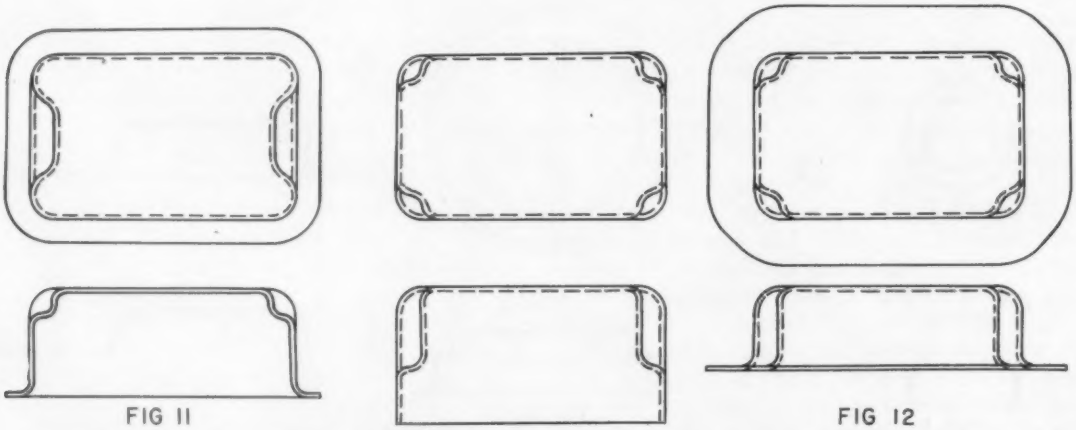
completely off, collar *D* is forced down and the upper portion of the shell is reduced in diameter. It is important that the first-operation shell be drawn off completely before collar *D* starts to descend. Otherwise the metal will have to draw around the drawing radius of the die at the same time the shell is being reduced. This would require a metal movement through 270°, which might cause the shell to break.

When the shell has a flange, as shown in Fig 6, a double-action press equipped with a double-action pressure attachment and a locking device must be used. A double-action die for performing blanking, drawing and redrawing operations complete in one stroke of the press is shown in Fig 10. The blank is cut between rings *A* and *B* and is drawn into the first-operation shell in the same manner as the die previously described. When the first-operation shell has been drawn to the correct depth the blankholder stops as shown in the second view. Now the punch slide descends and forces collar *C* down to reduce the upper portion of the first-operation shell. The radii of both shells are set and the shoulders are flattened in another die.

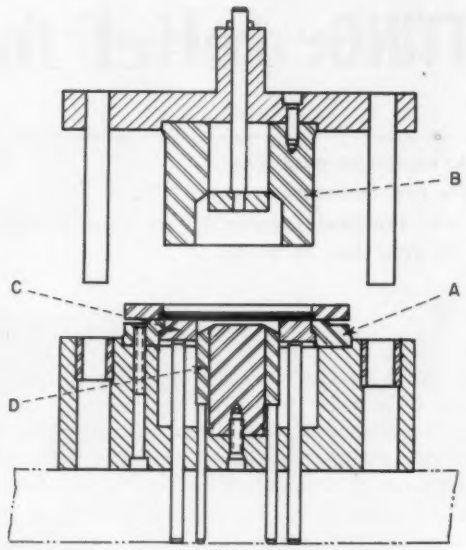
Shells with either shoulders or pockets in their sides, or at their corners, may be drawn in two operations, as shown in either Fig 11 or Fig 12. The choice of method depends upon the shape and the size of the pockets. If the pocket is comparatively shallow the method shown in Fig 11 should be used. With this method the shell is drawn to part-print dimensions, but without the pocket, in the first operation. The pocket is formed in the second operation by turning inside out that portion of the first-operation shell which is in the area of the pocket. The first-operation shell must be carefully designed so that there is just enough metal to form the pocket. If there is excess metal, the metal in the area of the pocket will wrinkle. If there is a deficiency, the metal will break before the pocket has been completely formed.

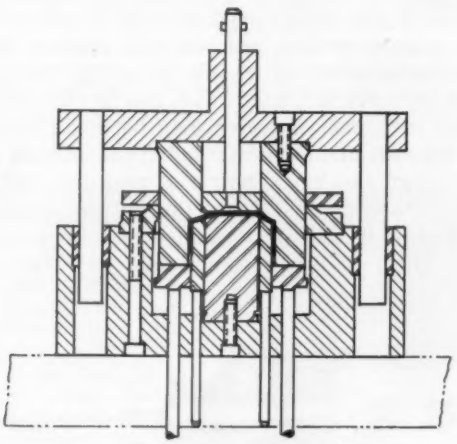
If the pockets are deep, and extend for a considerable distance down the sides of the shell, the method shown in Fig 12 should be used. The shell is drawn to as far as the shoulders in the first operation. The shell is then placed in the second-operation die to be drawn to its full depth. Provisions must be made in the design of the second-operation die to prevent the pockets from being pulled out of shape while the lower half of the shell is being drawn.

Part XXVII of Mr Cope's series will appear in an early number.

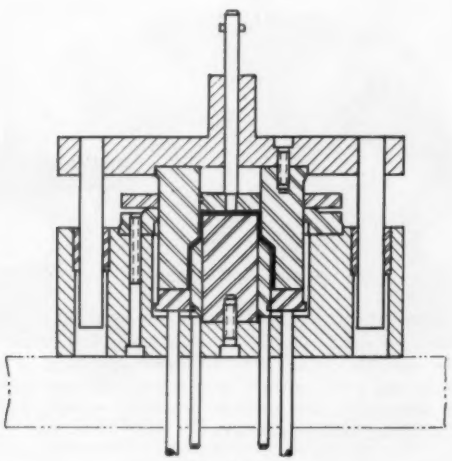


FIGS 11 and 12 . . . Depth of the pocket or shoulder influences die-design and method of die operation. In Fig 11, the first-operation shell has the pockets formed by turning the metal inside out. For the part shown in Fig 12, the metal is first drawn as far as the shoulders, and in the second operation, the wide flange is drawn



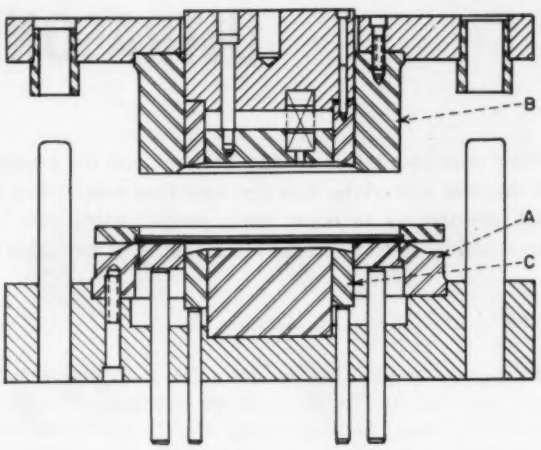


First-operation shell

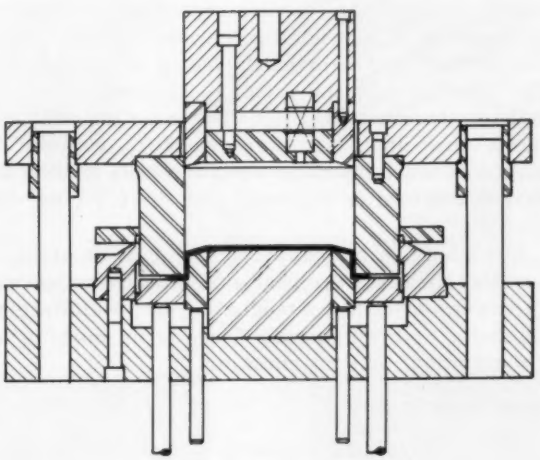


Finished shell

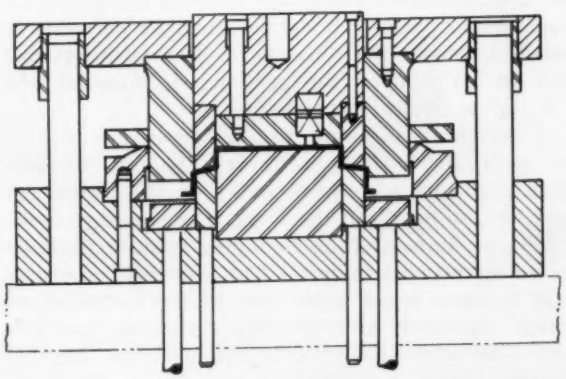
FIG 9 ... Shouldered round shells, as in Fig. 5, can be made on a single-action press equipped with a double-action pressure attachment. The outer two pressure pins support draw ring **C** while the first-operation shell is drawn. Then the upper portion of the shell is reduced by forcing down collar **D** which is supported by the inner set of pressure pins



Die Open



First Operation Shell



Completed Shell

FIG 10 ... A two-level round stamping with flange as in Fig 6, requires a double-action pressure attachment and a locking device, if the piece is to be made in one operation on a double-action press. After the first-operation shell is drawn, the movement of the blank-holder stops, and continued movement of the inner slide reduces the shell against draw collar **C**

ULTRASONIC CUTTING: relief for

Every once-in-a-while in shop practice you hit a snag, a bottleneck, especially with some of the new materials. You are sure that somewhere a solution to the problem must exist. Still mysterious to many shop people, ultrasonic machining is one practical remedy. Here is how it works, plus ideas that may be valuable additions to your bag of tricks

WM M STOCKER, JR, Associate Editor

Ultrasonic machining is done on a machine tool, such as the Sheffield-Cavitron machine manufactured by The Sheffield Corp, which has a vertical "spindle" and the appearance of a fancy slotter. It is intended to cut hard materials, frequently its cutting ability improves as hardness increases. Cutting action depends entirely on vibration in the sonic range or higher and occurs regardless of whether the material is or is not a conductor of electricity or is extremely brittle or hard. One of the first uses of this principle was the slicing of synthetic jewels to make instrument bearings. The machine will cut, carve, dice, drill, tap, shape contours, engrave, or otherwise machine materials into simple or intricate shapes, internal or external, and to very close tolerances.

Machining is accomplished without changing in any way the surface appearance, physical properties, chemical, electrical, magnetic, or metallurgical character of the material. There is no burning, no discoloration, and no checking.

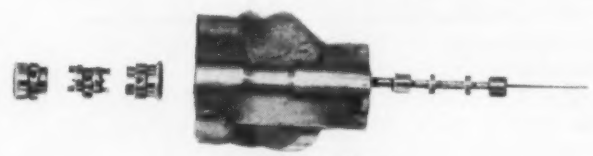
HOW DOES IT CUT?

Ultrasonic cutting is a fairly simple process; it can best be remembered by the abc's—abrasive, bombardment, and cavitation: Abrasives are used in granular form; the same abrasives as are found in commercial grinding wheels: boron carbide, silicon carbide, and aluminum oxide. These *materials must be harder than the workpiece,* and one charge equals four pounds. A liquid carrier such as kerosene is used to convey the abrasive to the working zone and to carry away the particles of material, the "chips," as they are removed.

These abrasive grains are tremendously accelerated up to 150,000 times the force of gravity (or more than 1100 tons per square inch), by the transducer and tool, to bombard the work. Their energy is released on impact, thus removing minute particles of the softer work material. The process is repetitive and, because many grains are at work simultaneously, thousands of particles are removed per second. This action results from the electrical and mechanical vibration phenomena produced within the transducer. Electrical energy to actuate the magnetostrictive transducer, which converts electrical energy into mechanical movement, is supplied by an electronic driver or generator which produces an alternating current having a controllable frequency range up to 30,000 cycles per sec.

The liquid carrier for the abrasive is cavitated (boiling action) by the ultrasonic force, thus producing turbulence of the abrasive grains and constantly presenting new cutting edges to the work face. Cavitation also helps to tear away loosened particles of material; is the same force that in ultrasonic *cleaning* strips dirt and grease away from the object being cleaned.

In roughing operations with 280-grit boron carbide, tolerances of ± 0.0005 in. and finishes of 25 mu-in. rms, or better, are common. Surface finish can be preselected by choice of proper grit. For greater accuracy and finer finish, one or more finishing cuts with finer abrasive may be made. Cutting speed depends upon material being cut, contact area between tool and work, power of machine, and grit size. Present equipment is not fast cutting; efficiency is in simplicity and performance of otherwise extremely costly or troublesome jobs.



ORIGINAL METHOD

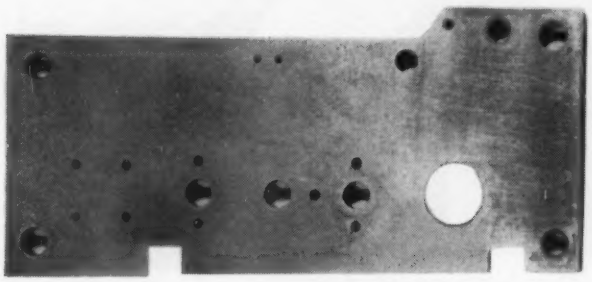
DESIGN CHANGED

DESIGN SIMPLIFICATION . . . Because of machining limitation imposed by four small slots, servo-valve sleeve had to be made from three separate pieces. With ultrasonic machining, a single-piece design was made possible with a soft-steel cutting tool to plunge-cut rectangular slots to finish dimensions holding 0.0005-in. tolerance on hole location and size

MINUTE ROUND AND IRREGULAR ORIFICES for air-gage bore-spindles can be cut after hardening, with resultant reduction in heat-treat loss and cleaning, plus better performance of gage

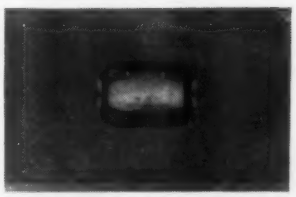
hard-material headaches

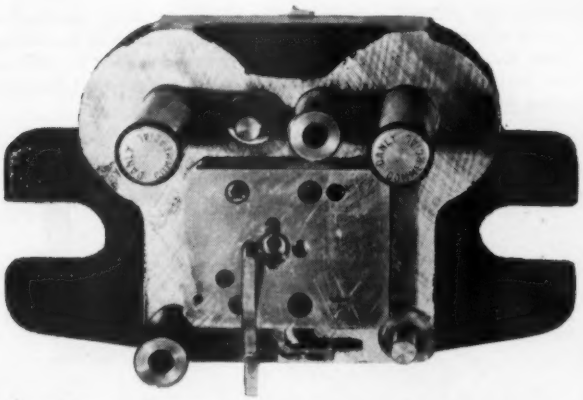
Die Alterations and Manufacture



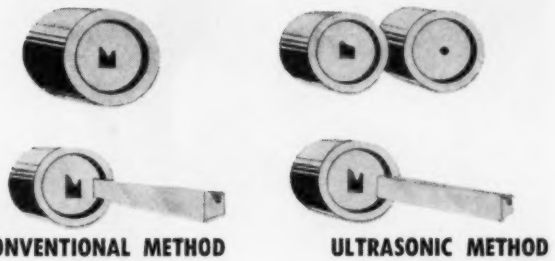
ALTERING HARDENED AND FINISHED TOOLSTEEL die by conventional methods might mean annealing the die, making changes by conventional techniques, and rehardening the die. Previously formed cavities may distort or surfaces may warp. Complete loss of the die is possible. With ultrasonics, the die can be reworked in finished, hardened state without affecting hardness, other holes, or surfaces in any way. Repair is clean, accurate, and fast

GEM-STONE-MOUNTING COINING-DIE cavity was produced with *soft steel* hobbed tools. After roughing surface is finished to high polish by same ultrasonic method using diamond pastes and the same hobbed tools. Method is low cost; permits sinking dies for shorter runs of jewelry without prohibitive expense

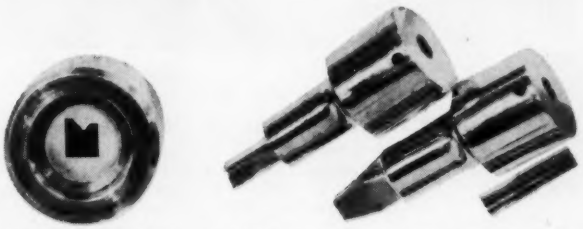




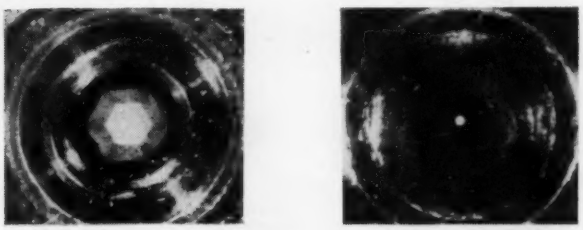
PROGRESSIVE BLANKING DIE requires irregular shape machined to profile tolerance by finish grinding. Usual practice is to split dieblock to permit grinding irregular shape. By ultrasonic method, simply harden solid dieblock and machine cavities directly from solid and to required profile tolerances. Thus, dieblock is stronger; manufacture is better and faster. Consider wherever shapes are complicated or irregular. Advantages are even greater when dies are manufactured from carbide



CONVENTIONAL METHOD ULTRASONIC METHOD

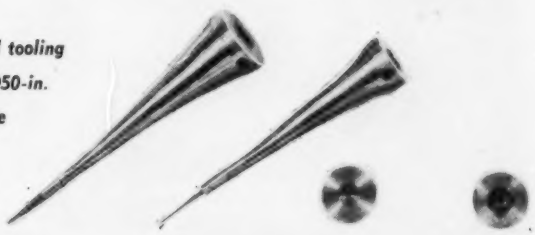


BAR-DRAWING DIES, of carbide, conventionally are made by pressing and sintering the form, then lapping with tapered laps and diamond abrasive. Job is time-consuming and requires both expensive skill and material. Using ultrasonic method, dies can be cut from solid or from worn die of different profile and by straight tools with correct form for both bearing and entrance surfaces. Job requires only semi-skilled labor and low-cost abrasives

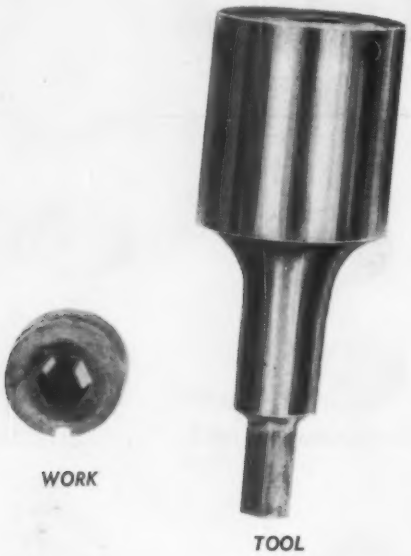


CONVENTIONAL METHOD ULTRASONIC METHOD

Actual tooling for 0.050-in. hex die

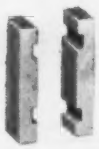


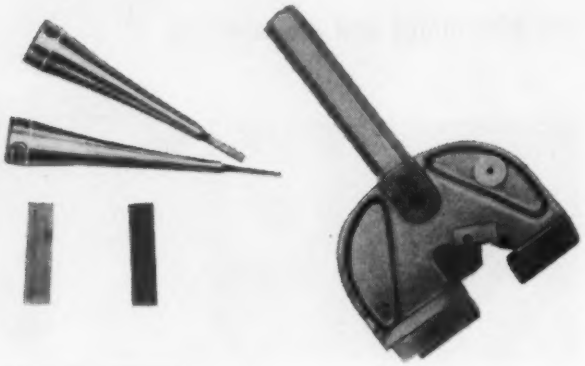
SHAPED-CARBIDE WIRE-DRAWING DIE ordinarily is pressed from powder with the die nib cored to shape, then sintered. Job requires special tapered tools, diamond paste, conventional vibrating laps, and much skill. Ultrasonic cutting permits use of inexpensive tools and abrasive plus semi-skilled labor; requires only one-fifth the time to profile within 0.0005 in. of finish size and surface to 10 mu-in. Final sizing and polishing is quickly done, by conventional lapping techniques, because only a few thousandths must be removed. Dies as small as 0.012-in.-dia opening are readily produced



HEXAGONAL-NUT DRIVER, of carbide, was ultrasonically cut from solid to replace conventional hardened toolsteel part. Saving was 70% over conventional method plus greatly increased wear life

CONVENTIONAL METHOD

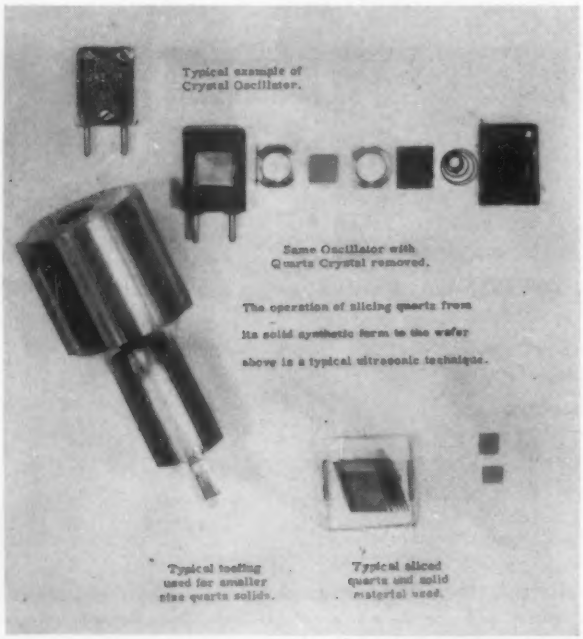




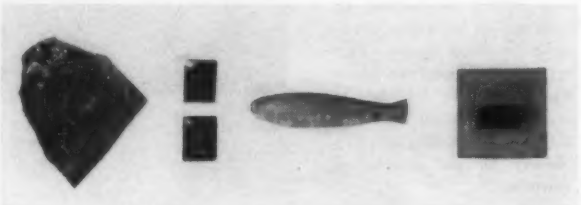
SONICUT METHOD

SLOTTED JET STRIPS for air snap gages were made by slotting two sections of carbide, slotting each section with a diamond wheel, and brazing the two sections together. Braze material clogged the slot, and a cleaning operation was necessary after assembly. Scrap loss approximated 50%. Now ultrasonic slotting is done in a solid carbide blank with inexpensive tools. Result is much lower cost, closer tolerances, and scrap loss under 2%

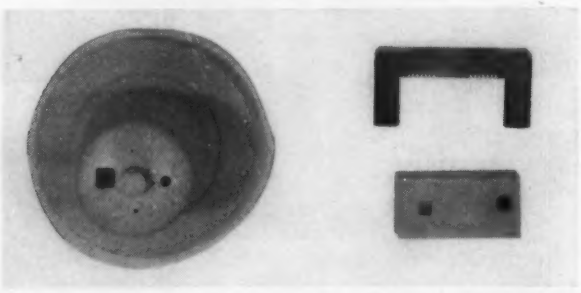
Cutting Gems, Ceramics, and Minerals


Typical example of Crystal Oscillator.
Same Oscillator with Quartz Crystal removed.
The operation of slicing quartz from its solid synthetic form to the wafer above is a typical ultrasonic technique.
Typical tooling used for smaller size quartz solids.
Typical sliced quartz and solid material used.

SLICING QUARTZ from its solid synthetic form to the wafer in the radio-frequency control crystal is a typical ultrasonic technique. Holes as small as 0.005-in. dia may be drilled and shapes of any irregularity formed without difficulty. As shown, tool construction is simple

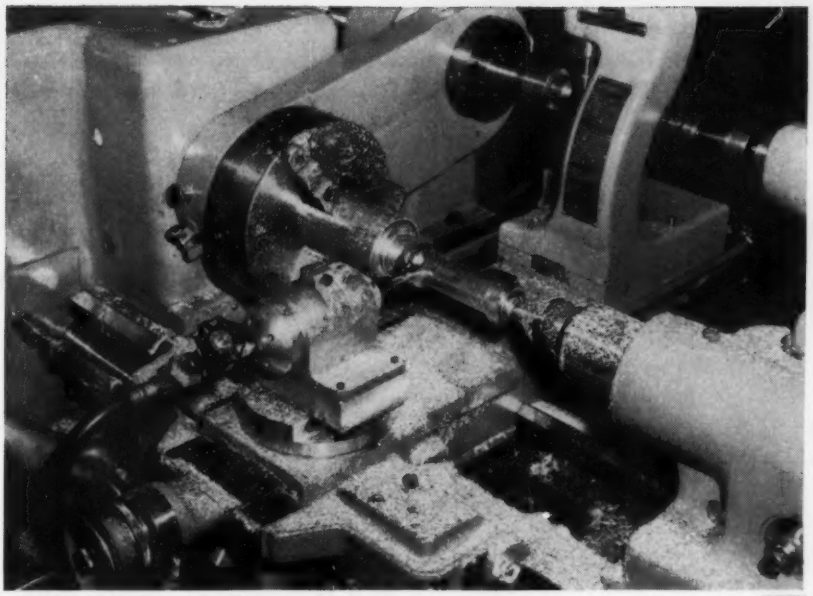


MANY GEM STONES, such as ruby and mother-of-pearl, are readily cut to intricate shapes by ultrasonics, and configuration limits are wide. Ruby, like sapphire, is used for commercial parts as well as for jewelry. Typical of these parts is the precision pivot bearing, sliced and formed by ultrasonic cutting



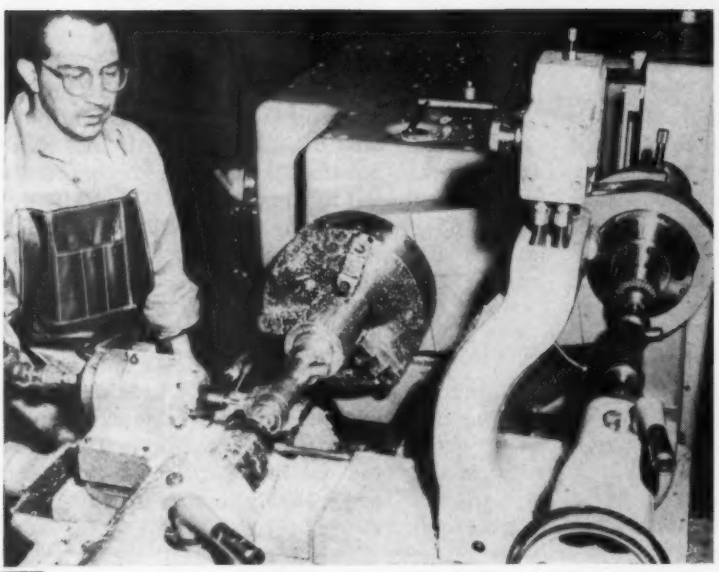
HIGH-SHRINKAGE FACTORS complicate manufacture of close-tolerance holes, shapes, and cavities in ceramic parts. As shown in this electrical insulator, even very fine holes and square cavities are readily cut in fired parts with ultrasonics. Similarly, magnetic ferrite for electronic cores and diamonite for high temperature, corrosion, or wear resistance are readily formed, drilled, and tapped to suit many applications

"Proto-Turning" replaces forging for short-run aircraft parts

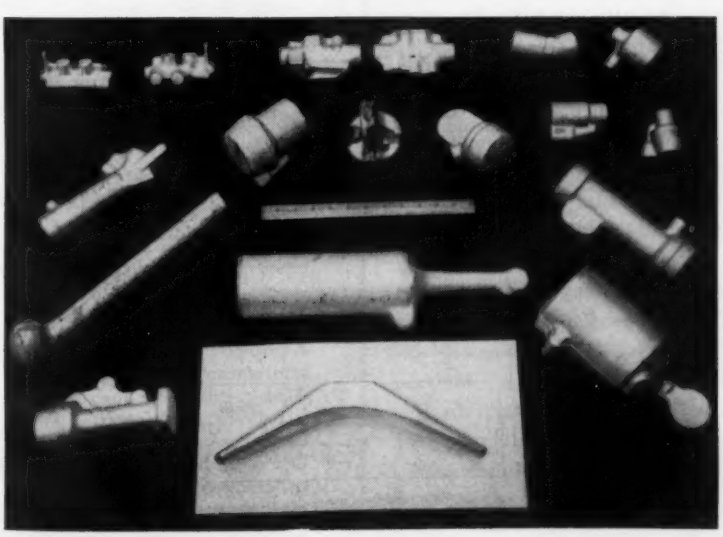


HIGH-SPEED ROUTER mounted on the cross-slide replaces lathe tool in "Proto-Turning." Router tools are conventional (usually long, narrow, tapered) and rotate at speeds to 23,000 rpm. Router drive is 7½-hp, 360-cycle motor lubricated with lard oil and kerosene—also used as cutting oil

A routing head, mounted in a copying lathe at Douglas, solves the problem of economical production of prototype "forgings". Expensive, time-consuming forging dies are avoided in short-run part production by routing in a lathe. The modified Model 32 Sydney Fluid Tracer lathe is a joint development of Sydney Machine Tool Co, Sydney, Ohio, and Douglas Aircraft Co, Santa Monica. Dimensional tolerances are held to ± 0.002 in. on production without difficulty. Speed of cross-slide travel is increased to 70 ipm.



REVOLVING TEMPLET is mounted in special revolving master tailstock that rotates in 1:1 speed ratio with lathe spindle. Hydraulic tracer controls cross-slide movement. Speed reducer cuts spindle speed, can be disconnected for conventional lathe operations



ROUND OR FLAT BAR STOCK is chosen as needed. Any part for which a templet can be made can be cut by process. Average parts are available the day after drawings are completed

How many machine tools in the

Soviet Russia today has more than 1,300,000 machine tools—almost twice as many as in 1940. Yet this total is only 56% of the US total, and average productivity per machine tool is less than half the American

Soviet leaders have long recognized that their metalworking industry is the heart of Russia's industrial and military power. This is the industry which produces the equipment needed for expansion of national production in any segment of the economy. It is the industry which produces the main sinews of war and can be converted solely to military production.

In the light of these facts, the Soviet Government has—since the early 1930's — steadily kept its main attention turned to developing and improving Russia's metalworking capacity.

This comparison of this key Soviet industry with its American counterpart uses as a standard the existing stock of machine tools and metal-forming equipment in both countries. Figures for the Soviet Union are estimates based on official Soviet publications; except where otherwise stated, they relate to the period of about 1950, but can be taken as roughly indicative of the present park* as well (see Chart I). United States figures are taken from the *American Machinist* inventories (see *AM*—Mid-Nov '53, pA1-A97).

There is every reason to believe that the size of the machine-tool park planned in the Fourth Five Year Plan for 1950 was not far from what was actually realized. Assuming this to be the case, the Soviet park in 1950 was 83% greater than in 1940, but was still only about half the size of the American 1953 total.

EDITOR'S NOTE

This study of Russian machine tools is taken from a larger study and is based on Soviet sources. The author is an economist specializing in the Soviet field. He learned Russian and engaged in general study of the Soviet Union at the Russian Institute at Columbia University. He has studied Soviet industrial management under a Social Science Research Council Followshp. Documentation for this article will be found in his study, "Postwar Technological and Organizational Developments in Soviet Machine Building," published in *The Soviet Railroad Equipment Industry: A Technological Approach to Economic Analysis*, Institute for Research in Social Science, University of North Carolina, October, 1954.

TYPES OF MACHINE TOOLS

While the absolute number of machine tools existing in the Soviet Union is obviously of great importance, no less critical is the question of the proportions in which the various types are found (see Chart II).

Compared to the United States, the greatest weakness of the Soviet park lies in the relatively little weight given to grinding machines. In contrast, lathes play a predominant role. The relatively unproductive and rough-cut planers and shapers are also of great numerical importance in the Soviet park, while they comprise only a negligible share of the American stock of tools. Percentage figures probably are in the order of 10 and 1.5% respectively.

These comparisons between the two national machine-tool parks refer to the total for all metalworking industries. If we consider only the job-lot industry, the composition is still less favorable to the Soviet Union.

On the other hand, present-day differences do not seem appreciable in mass-production industries. In these industries, the more highly productive types of equipment play almost as large a role as they do in the United States. This may be seen from data for the automotive industry (Table I), where the national differences expressed are probably smaller than the margins of error inherent in the data.

This relatively strong structure of the Soviet automotive industry represents a radical improvement over prewar. It need not surprise us that Soviet leaders should have concentrated their more highly productive metal-cutting equip-

**Park is used in this article in the military sense of the total amount of a type of equipment.*

table I . . . MACHINE TOOLS IN THE AUTOMOTIVE INDUSTRY

(Percent of total machine-tools in the industry)

	Soviet Union		United States
	1950 (Plan)	1952	1953
Automatic and semi-automatic lathes	8.0%		8.8%
Gear-cutting machines	5.0		6.6
Broaching machines	1.3		2.1
Centerless grinders	1.7		2.3
Grinding, honing, lapping polishing, and buffing machines		25%	28

Soviet Union?

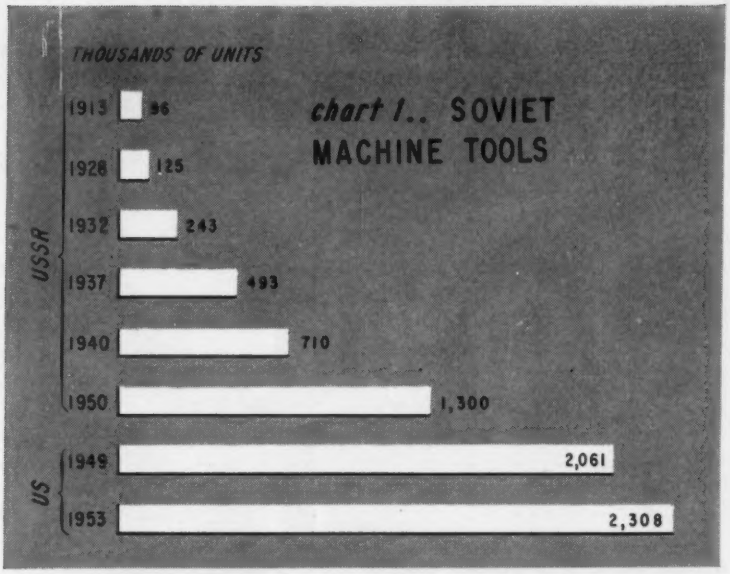
DAVID GRANICK,
associate professor of Economics,
FISK UNIVERSITY, NASHVILLE

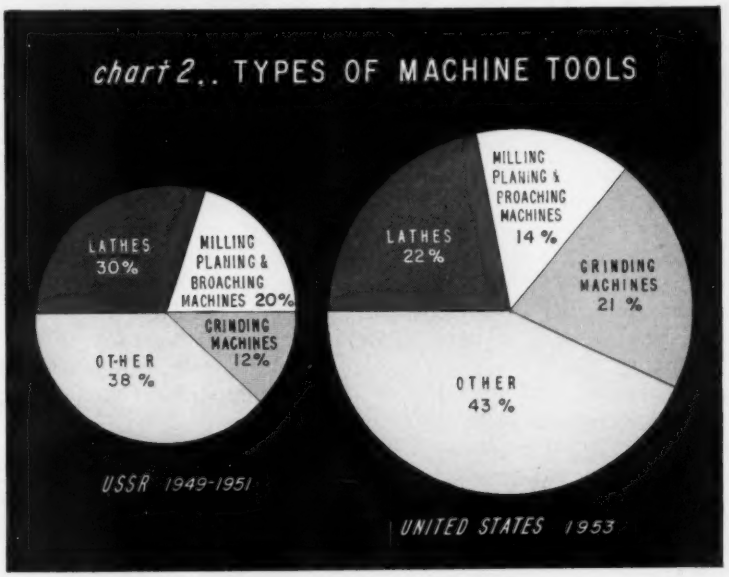
ment in the mass-production industries where they could be used to the greatest advantage. But even in job-lot industries the structure of the park has radically improved.

Table II presents a breakdown by types of the pre-war park in the metalworking-machinery industry. At least as regards lathes, these figures may be fairly compared with the 1949-51 figures in Chart II for the Soviet Union's entire machine-tool park. This is said on the basis of a comparison with the United States 1953 *American Machinist* inventory, where the percentage of lathes to all machine tools was about the same for all metalworking industries as for the metalworking-machinery industry alone.

A comparison of Table II with Chart II shows the continued deemphasis on lathes in the Soviet machine-tool park. From about 48% of machine tools in 1932, they fell to 38% in 1940, and to 30% or slightly less by 1949.

In contrast, the figure of 12% for the proportion of grinding machines to total machine tools in 1949 represents a marked advance from the pre-war 4%. This advance still leaves the proportion of grinding machines in the Soviet Union at not much more than half the American ratio.





AGE OF EQUIPMENT

In addition to the present Soviet machine-tool park being composed of more productive types of equipment than was the case before the war, there is no doubt that the more recent tools are heavier and have considerably greater power capacity. On the other hand, to partly counteract these favorable features, there has been a marked aging of the park. In the 1930's, the equipment was much newer on the average in Russia than in the United States, but this advantage has been lost during the war and postwar period. In fact, it would appear that the present Soviet park suffers to the same extent as does the American park from a high percentage of old equipment.

METAL-FORMING EQUIPMENT

Soviet writers acknowledge that one of the most important signs of

table II . . . MACHINE TOOLS IN THE MACHINE-TOOL INDUSTRY

(Percent of total machine-tools in the industry)

	Soviet Union		United States
	1932	1940	1953
Lathes	48.1%	38.2%	15.9%
Drills	16.1	10.9	14.8
Milling machines	11.3	11.0	14.0
Sub-total	75.5	60.1	44.7
Grinding machines	8.3	9.8	25.3
Gear-cutting machines	1.8	6.5	2.8
Other	14.4	23.6	27.2
Total	100.0	100.0	100.0

the technological level of a nation's metalworking equipment is the proportion of metal-forming to metal - cutting equipment. The higher the percentage of metal-forming equipment, they say, the greater the economies of both metal and labor.

Despite their recognition of its importance, the field of metal-forming equipment is one in which the Soviet Union is particularly deficient. While in 1953, the number of units of forging and pressing equipment in the United States was 17% of the number of machine tools, the 1948 figure in the Soviet Union was only 12%.

Thus the American proportion is more than a third greater than the Soviet. Even more interesting is the fact that the Soviet 1948 percentage represents no serious rise above the 1940 level, and that there is no indication that later years have seen improvement.

Within the field of metal-forming equipment, the Soviet park is extremely top-heavy in hammers. Although it is recognized that hammers are more versatile than presses, virtually all Soviet writers consider presses to have higher productivity both per machine and per operator, and they lay even greater stress on the metal-saving features of hot presses.

Yet while hammers comprised only 4% of the total number of forging and pressing units in the United States in 1953, the Soviet proportion is at least 10 times as high. In 1949, hammers made up more — and perhaps considerably more — than half the total number of pieces of equipment used for forging and hot pressing.

PRODUCTIVITY

It is difficult to find a proper measure of the average productivity of Soviet metalworking equipment as a whole. In searching for a proper index, it has seemed advisable to concentrate on machine tools and to estimate their productivity by the amount of total steel produced in the country divided by the stock of machine tools in existence.

With this measure, Table IV, we find that average Soviet machine-tool productivity is less than half the American level.

A number of possible objections to this measure of productivity may be raised. The most important is probably the question of whether the proportion of total steel production which goes to the metal-working industries is the same in the United States and in the Soviet Union.

However, a study of this question indicates quite clearly that the proportions are surprisingly similar.

Again, it might be asked if the degree of fabrication is greater in the Soviet Union. To the contrary, it seems likely that, if anything, the reverse is true. Thus the measure of productivity does not seem inappropriate.

Soviet machine tools are far less productive than American tools partly because of their smaller motor capacity, the less extensive use of carbide cutting tools, and the smaller percentage of automatic equipment.

Equally important are differences in the organization of the metal-working industries in the two countries: the much greater development of mass production in the United States and the extension of subcontracting and of specialization of plants.

Finally, it seems likely that a substantial proportion of Soviet machine tools is composed of specialized equipment built during World War II for military production and designed to perform a single operation on a particular type of product. It is quite possible that many of these tools have been put in storage in the post-war period. Because they are included in the Soviet park, the productivity of those machine tools kept in operation is understated.*

SOURCE OF SOVIET DATA

All of the material presented in this article on Soviet metalworking equipment is based on official Soviet publications. Some of the figures are official; many are the writer's own estimates based on these sources.

None of the figures should be taken as precise. On the other hand, they are believed to be sufficiently accurate for the purposes for which they have been used: broad comparisons with the United States and major trends within the Soviet Union itself.

It is not certain that the definition of "machine tool" used in the Soviet Union is the same as that used in the United States. This problem is particularly relevant for Chart I, which compares the number of machine tools in the two countries. However, if there is a difference, the Soviet concept is broader and so the relative difference is understated.

table III . . . AGE OF US AND SOVIET MACHINE TOOLS

	At Least 10 Years Old	Over 20 Years Old
SOVIET UNION		
1938	23%	
1941	less than 23	
1954	45-55	20-25%
UNITED STATES		
1935	67	
1940	72	
1945	38	
1953	55	20

table IV . . . PRODUCTION OF CRUDE STEEL PER MACHINE TOOL

Soviet Union	1950 Plan	19.5 tons
United States	1953	43.9 tons

**In the US, the 1949 American Machinist Inventory included a substantial number of both general and special machines in military storage. In 1953, most of these had been returned to service. Another factor that might influence productivity would be the relative hours of utilization per week*—EDITOR.

American Machinist

SPECIAL REPORT NUMBER 389

Linear Programming

ROBERT O FERGUSON,
principal, METHODS ENGINEERING COUNCIL, PITTSBURGH 21

as told to KENNETH L KLINE, assistant editor

Suppose you operate a shop with four screw machines, and you have six products (with different profit margins and machine times), that you must produce in given quantities. One of your machines is an old clunker, and has a slow cycle. Two are middle-aged, and the other one is brand new, and fast as lightning. How do you schedule your parts on the machines so you get the most total profit?

This is the kind of problem on which Linear Programming can help. It's a system of organizing and simplifying data in a given physical problem down to the point where it can be solved — or, at least, understood — by calculations no more complicated than algebra.

It's a management tool that has tremendous possibilities for increasing profits, reducing machine downtime, minimizing transportation costs—or whatever else you are aiming for.

It has been said that a good management man is anyone who is right better than 50% of the time. Management decisions are often that difficult. An executive bases his decisions partly on experience, partly on theory, and often on educated hunches. Linear Programming allows a much more accurate hunch; in fact, it eliminates the necessity for hunches in some cases. It also allows more educated guesstimates.

The theory behind Linear Programming is complex, but in practice it is fairly simple. You set down on paper certain facts about the problem, organize the information into a kind of box outline, and run through some simple mathematics to produce the *best* answer (or answers) for your particular case.

In the following pages you can find out how Linear Programming works, what it does, how to use it, and what its values are.

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What is linear programming?

Linear Programming is a method for picking a *best* choice when choices exist. In other words, it is a formal method of calculating the *best* solution to a problem or situation where many solutions or management decisions are possible, depending on certain limiting conditions.

Too often management is faced with a jungle of figures, such as schedules, machine loads, costs, and inventories. The manager is expected to use this information to get the most out of his plant. It is often impossible to cope with this situation, and the manager simply does the best he can, hoping for just *some* answer that will get the product through Manufacturing at a profit.

How does Linear Programming differ?

Most standard production-planning methods are set up just to get *an* answer, rather than the *best possible* answer. You try to get the best balance of inventory, available machine time and the orders you have to run, and you're satisfied generally if a program can be found that will finish the work within the time available. As you will see from the case histories here, with the programming approach, complex scheduling, loading, and distribution problems are handled simply and mechanically and furnish the *best* answer, in terms of least cost, greatest number of parts, or some other standard.

Also, Linear Programming will provide information on alternative answers to the production problem, telling what is lost in terms of profit or hours or number of pieces, when using less than the best program.

Linear Programming can do these things because it is a special way of handling information mathematically, by going through a finite number of mathematical steps, to the answer which is being sought. As we will see later on, information is recorded in a very particular manner, and is treated according to specific, rigid rules. And when the answer is found, it can be checked accurately to be sure that it is correct.

Where does LP work?

Linear Programming can be used in two broad areas of production management — planning and scheduling. As you will see later, there are five principal methods of solving the problem, once it has been set up. Each of these methods has a special usefulness to one and/or the other broad area of management. The methods are: Index, MODI, Distribution, Simplex, and Ratio Analysis.

Scheduling methods

Easiest is the Index method. It is quite inflexible, applicable only to certain kinds of situations, and very easily solved—daily (or even hourly) when new information makes this necessary. The Index method has been used mostly for *scheduling* parts into specific machines, or otherwise loading work into productive facilities—a technique that is done more or less "by inspection," once the Index solution has been solved (see p 127).

The Index method works here because it can take into account the large amount of detail that must be considered when planning production; such as orders, quantities, machine capacities, inventory level, and rate of production; and arrive at a best program in relation to over-all objectives. For example, when many orders are scheduled to a large number of machines, a considerable amount of detail is involved which can best be handled when all orders are considered simultaneously, rather than one or a few at a time. In other words, to get the best program, you must evaluate the effect on all orders of assigning each order to a machine.

This is not normally done because the tools for doing so have not been available. It is not humanly possible to work out a best combination of orders when there is a large number of each, and a number of alternate ways of producing them. This combination can be found with Linear Programming, which, for this purpose, is a technique for scheduling orders as a group in the best way possible for the scheduling period being considered. This often results in some orders not being run on the best machines. But all orders, machines, quantities, and the like, are considered together. Therefore, the end program is the *best* one for over-all return.

In addition to providing the scheduling department with a best program, the programming approach contains information on alternate methods which permit planning and operating personnel to meet interruptions when equipment fails, or when special and rush orders are received. Information is arranged in an orderly manner, and can be treated systematically. Thus, the emergency can be smoothed out in the quickest way possible, with the least added expense and disruption of production schedules.

The planning methods

Of the planning methods, the Simplex is very flexible, but time-consuming and difficult to solve. It is generally used on a one-time basis, to get an over-all idea of the problem, as well as to solve for the best solution possible with the given information. Distribution and MODI (Modified Distribution) are special techniques which are somewhat easier to use. These methods can be applied for day-to-day *planning,* in such applications as balancing distribution and manufacturing costs, deciding whether to make or buy certain parts, and computing the profit effect of price and cost changes.

Specifically, the "planning" methods can be used for:

Whether to make or to buy . . From the standpoint of most profit or best delivery, it is often better to make than to buy certain parts, yet a relation of costs between purchased and manufactured parts is often obscure, especially if parts are being "purchased ahead" to meet future assembly schedules. Linear Programming helps make the relationship much clearer by finding the most profitable parts to subcontract, and then incorporating those parts into the best schedule, which ties both purchased and manufactured parts together into a common program with common objectives.

Balancing production and distribution costs . . When several plants are making the same product, at different costs and production rates, it is often customary to make the parts in the plant nearest to the customer. This often results in less profit than if the part had been made in a more distant plant and shipped farther, because the production saving offset the difference of transportation cost.

Leveling employment when demand is cyclical . . When demand is cyclical, it is often hard to keep a constant level of employment in those departments where skilled help is hard to find. A trial method has been worked out to tell management how many of each of several parts should be made ahead of schedule to keep equipment and manpower busy at a constant rate throughout the year, at lowest penalty in inventory cost.

There are other uses for Linear Programming, and the number of applications is growing rapidly.

Basic information needed:

Most Linear Programming problems will require the following general information:

1 . . The general manufacturing process and sequence of operations used to produce the products.
2 . . The product line, including all regular and special products.
3 . . Customers, by product, and location.
4 . . Rate of production by product, by department and by machine.
5 . . Customer demand for a given time period.
6 . . Effective available machine time, including utilization, downtime, and the like.
7 . . Cost and price information by product, operation, and machine group.

In addition, production planning and control problems will require information and data about the following:

1 . . Current scheduling practice, such as basic approach, methods, procedures, and controls.
2 . . Range, size, and variety of products and parts.
3 . . Time, models, and number of machine tools.
4 . . Purchasing methods, status of delivery promise, and tooling.

	DEMAND IN PIECES
ORDER	
A	200
B	150
C	400
D	600
E	420
F	150

HOW WOULD YOU assign orders A, B, C, D, E, and F to machines 1-4, with this production information? This problem is worked out for you on p 132-3

RATES OF PROD-PCS/HR

MACH / ORDER	I	II	III	IV
A	18	20	10	16
B	45	50	25	40
C	9	10	5	8
D	27	30	15	—
E	9	10	5	8
F	—	75	—	

ACCOUNTING COSTS $/PIECE

	I	II	III	IV
A	2.50	2.00	4.	3.
B	1.20	1.00	1.70	1.50
C	0.65	0.60	0.70	0.80
D	4.00	3.00	4.50	—
E	3.00	2.60	3.20	3.40
F	—	1.80	—	—

SELLING PRICE $/PIECE

5.10
2.00
1.50
6.80
4.00
3.00

AVAILABLE CAPACITY - STD MACH HRS

	MAX HRS AVAIL	% UTIL	EFFECTIVE AVAIL HRS
I	40	0.950	38.0
II	40	0.970	38.8
** III	80	0.800	64.0
IV	40	0.870	34.8

** OPERATES TWO SHIFTS

5 . . Time standards for running various parts on best and alternate machines.
6 . . Setup times and setup codes.
7 . . Available machine time by group and department, including percent utilization, downtime, and delays.
8 . . Method of assigning people to machines.
9 . . Inventory practices and procedures, and lot sizes.

How Mueller Brass saved 20% with LP

Mueller Brass is an "integrated" producer, making approximately 3500 different standard products, which comprise 40% of the total output of the plant, and many different special products. Lot sizes of special products range from 1 to 1,000,000 pieces, and make up the remaining 60% of output. Most of these products are processed in the Brass Shop, a general-purpose machine shop in which there are about 200 machines, ranging from simple drillpresses to 12-station dial-feed machinery. About 250 orders pass through the Brass Shop in an average week.

Those parts that can be run on more than one machine are scheduled by the Index Method of Linear Programming. Personnel required to maintain the index number system includes one full-time production planner. Information on tooling and routing is furnished by the Methods Department as needed. The Linear Programming setup has given the company a number of benefits.

Direct savings in the Brass Shop amounted to 15 to 20% of excess hours as a direct result of the installation. Also, by improving scheduling through the Brass Shop, customer promises for delivery were immediately improved.

Many side benefits result. For instance, this scheduling method permits balancing manpower over the equipment that is to be run, which could not be done with standard scheduling methods, because the exact order sequence would not be known. In addition, excess hours ("excess hours" means the number of hours more than "ideal" machine time) are controlled and accounted for, so management can keep a close watch to see that production moves through the shop as planned, or, if not, to get at the cause for the delay.

Another important gain with this system is that production planning management can control the sequence and location of orders much more closely than was previously possible. Thus, Linear Programming provides a valuable means of controlling the various factors of the normal production operation.

The Linear Programming installation was started because management foresaw the possibility of improving delivery promises and reduction in cost through its use. A preliminary study showed that sufficient improvement was possible to justify the setup. After discussion with management, the Brass Shop was selected as the place to begin, because it was a key department in the production process. As such, Linear Programming methods were used to obtain a more effective assignment of orders to machines, to get greater production.

Because there must be alternate methods of doing work in order to benefit from Linear Programming, the next step was to seek alternative manufacturing methods and machines for producing the orders. Focusing attention on the alternates brought to light methods that had been proposed in the past but had seldom been used.

In some cases it was possible to come up with new methods and routings, which helped considerably. It was then possible to run some parts on as many as 4 or 5 machines of different types. With these alternates, it was possible for LP to develop the best combination of orders and machines.

With emphasis on the alternates, as new orders came in, more and more new methods and tooling were considered and developed. In some cases, the new methods turned out better than the ones that would have been selected, if alternates had not been considered. *Notice that this benefit occurs even before the actual Linear Programming starts.* This is typical of the programming approach, which has perhaps as many side benefits as it has direct benefits.

Another advantage is that LP helps management to treat a large amount of information in an orderly and systematic way. It helps, for example, in considering the advisability of purchasing tooling for alternate machines.

You have seen the steps in the preliminary examination of the problem on the standard check list (p 123). The next step was to accumulate all information in a place where production planning could use it. To do this, a card was made up which contained such information as part number, release date, time per piece, number of pieces on the release, and setup time. Also listed here was information figured for alternate machines when needed. Thus one card held all the necessary information for each operation in the installation. These cards were then filed by date, in the order in which they were scheduled.

Handling methods

The scheduling procedure also had to take into account the tooling. The procedure was set up so that the presence of the card in the planning department schedule-file meant that the tooling was available.

The original order is submitted to production engineering. Its received time is stamped, and shop orders are made up from the original release. Copies of the shop orders go to the various departments which are involved in the production of the part.

Included on the Brass Shop order ticket is a list of operations to be performed and the time needed to do this work. Alternate methods are given for the various operations, with the total time needed to perform the job on these less-than-ideal machines. No setup times are included in the operation times, but setup times are treated separately at the time of establishing an index number.

Because the problem was one of getting the most parts out in the shortest time, the cost of the machine operation was ignored, and the problem was solved for minimum time. This is one of various solutions which could have been found in this particular case. Other solutions could have been found for best use of equipment and material.

Notice the general method that was applied here to arrive at "least-time." First, a preliminary survey established that the schedule could be better than it was. Second, detailed information on all aspects of the problem was found, such as running times, setup times, number of pieces for ideal lot size, and so on. Third, the terms of the problem—least time —were established, and finally the solution method was set up. If the terms of the problem had been different, maximum profit, for example, profit and cost information would have been used in setting up the solution.

Another use of Linear Programming which is being considered at Mueller Brass is in planning whether to make or buy certain products. In one product line, the company can sell more than it can make. The MODI method of Linear Programming is being tested to see how to revise the pattern of purchase-make selection. Preliminary results indicate there is a profit-improvement possibility.

The extra profit would result from the fact that LP shows products for which distribution costs are outweighed by production profits. In other words, production profit should be measured in dollars per machine hour, rather than in dollars per piece. When values are expressed this way, some surprising facts turn up which permit making higher profit with the same equipment and product line.

When the purchase-make matrix is solved, showing the most profitable manufacturing program, a "priority list" of products is set up. Starting from the top, products can be assigned to equipment until capacity is reached, and remaining products on the sales forecast are purchased.

An interesting fact showed up in the preliminary work on this problem. Apparently the most profitable program and most quantity program are not the same. Although the "most quantity" solution gives considerably more pieces, the "most profit" program results in a significant dollar improvement in net profit.

			ALTERNATES												
PART NO	QUAN	OPER	15 N. B. 11-2A	B GOSS 11-5	6 CHUCKER 514	16 #2 H.S.10-1	11 #4 H.S 10-2	6 #6 H.S.10-3	12 KINGS 524	4 KINGS 22-3	4 505	5 UNIV 8-2	6 UNIV 8-3	1 FLEX 9-1	MISC
			28	31 1.1			65 2.52								
					52		180 3.46	208 4.0							
					6		31 5.15	34 5.7							
			24	26 1.08			124 5.84	170 7.1							
			3	3	3		12 4.0								
				3			18 6.0	22 7.33							
			4	3											

Information check list to determine applicability of linear programming

To find if Linear Programming Methods will work in a given situation, these questions must be answered "yes."

A . . Can the problem be stated so that the objective desired is understood and set forth clearly? In other words, can we state what we want to do?

B . . Are there alternatives which can be used to obtain the objective?

C . . Are there restrictions or limitations to obtaining the objective?

D . . Can the objectives, restrictions, limitations, and conditions of the problem be expressed as linear equations and inequations? This step indicates whether the problem is one that can be solved by Linear Programming. It provides the point at which a method can be considered, and often gives a better insight into the problem than existed before.

The index method and how it is used...

We have seen how the Mueller Brass Co went about installing Linear Programming in the scheduling of the Brass Shop. It was mentioned that Mueller Brass used the Index Method to compute the best schedule. To see how the Index Method works, let's go through a typical example.

This problem is much simpler than usually encountered, but the method applies to more complex applications. It is especially effective where time is at a premium, and the problem must be resolved frequently.

Let's say we have six different pieces to run, and five machines through which the parts may run. Standard time data give us the number of hours each piece takes to run through each of the various machines.

ORDER	STOCK SIZE	PIECES REQUIRED
A	0.985	60
B	2.125	20
C	1.050	40
D	1.050	80
E	1.500	100
F	1.225	35

ORDER	A.S.M. GROUPS LISTED IN ORDER OF INCREASING STOCK SIZES				
	I (5)	II (1)	III (6)	IV (5)	V (6)
A	3.0	0.5	1.0	1.5	—
B	—	—	—	7.0	4.0
C	2.0	3.0	6.0	4.0	9.0
D	2.0	4.0	3.5	3.0	3.2
E	—	6.0	2.0	3.0	4.0
F	—	6.0	2.0	3.0	3.0
HOURS AVAIL	160	32	200	160	190

The Index Method is a means of comparing the ideal machine (machine which takes the least time to do the job) with alternate machines. It is a visual-inspection method whereby as many parts as possible are run on ideal machines, and those parts which overload ideal machines are run on next best alternates.

To arrive at an index number, the time for the ideal machine is assigned an index number of zero. For example, Part A runs in Machine 2 in ½ hr per piece. The index number for Part A Machine 2 is zero. To find the index number for Machines 3 and 4 for Part A, subtract the ideal time (0.5 hours) from the alternate time, and divide this number by the "ideal time." Thus, for Part A, the index number on Machine 3 is 1.0 and on Machine 4 is 2.0. The index number for Part A on Machine 1 is 3 – 0.5 or 2.5 ÷ 0.5 or 5.0.

In a similar manner, index numbers can be completed for all different parts for those machines on which the parts can be run.

These index numbers are:

ORDERS	MACHINES									
	I		II		III		IV		V	
	HRS/PC	INDEX	HRS/PC	INDEX	HRS/PC	INDEX	HRS/PC	INDEX	HRS/PC	INDEX
A	3	5.0	0.5	0	1.0	1.0	1.5	2.0	—	—
B	—	—	—	—	—	—	7	.75	4	0
C	2	0	3	0.5	6.0	2.0	4	1.0	9	3.5
D	2	0	4	1.0	3.5	.75	3	0.5	3.2	0.6
E	—	—	6	2	2	0	3	.5	4	1
F	—	—	6	2	2	0	3	.5	3	0.5
TOTAL HRS AVAILABLE	160		32		200		160		190	

LINEAR PROGRAMMING . . . A SPECIAL REPORT

Included in that table are hours of machine availability, a value which has been corrected for machine downtime, operator fatigue, and so on.

We are now ready to begin loading parts into the machines. The first step is to select for each part the ideal machine in which the part can run. These values are then listed in another table in which the index numbers also appear. In this way each part is first scheduled for a machine with a zero index number, the value in the table being the number of hours required to run the part in that machine.

When this information has been entered, the table looks like this:

	1	2	3	4	5	EXCESS
A	180 [5.0]	(30) [0]	60 [1.0]	90 [2.0]	– [–]	
B	– [–]	– [–]	– [–]	140 [0.75]	(80) [0]	
C	~~80~~ [0]	120 [0.5]	240 [2.0]	(160) [1.0]	360 [3.5]	80
D	(160) [0]	320 [1.0]	280 [0.75]	240 [0.5]	256 [0.6]	
E	– [–]	600 [2.0]	(200) [0]	300 [0.5]	400 [1.0]	
F	– [–]	210 [2.0]	~~80~~ [0]	105 [0.5]	(105) [0.5]	35
TOTAL AVAIL	160	32	200	160	190	
REQUIRED	240	30	270	–	80	

INDEX METHOD MATRIX, showing first solution with time required on each machine for ideal answer. Orders which overload machine have been crossed out, with alternate methods circled with dotted lines, to show "less-than-the-best" assignment

Now we add up the total number of machine hours which would run the ideal parts. In some cases all parts can be run on the ideal machine. And in others, we will find machines are overloaded, as is the case here. The next step is to begin a visual inspection and selection of machine parts to be rescheduled in order to gain the least excess time over the ideal number of hours.

Machine 1 has two orders which total a greater number of hours than those available. Because one order, Order D, has the same number of hours as the machine has available, we would normally look for an alternate method for Order C to remove the overload from Machine 1. Machine 2 is almost fully loaded, so it is not considered. Machine 3 is overloaded already, but Machine 4 has 160 hours available, and has no orders on it yet.

Therefore, a reasonable place to put the order is on Machine 4, which is the second higher index number. This replacement of the order involves adding 80 hours to production time, so that we list in the table a value of 80 excess hours.

We see that Machine 3 has three orders, with a total time of 430 hours. There are only 200 hours available on the machine, so we will have to find other methods for at least two of these orders.

The next overload order we will consider is Order F, which is on Machine 3. Looking at the number of available hours left on the various machines, we see that Machine 5 has 110 hours open time and seems like a reasonable place to put Order F, because Order F requires 105 hours to complete on Machine 5. Another reason for considering only Machine 4 and 5 at first is that Machine 2 has an index number of 2.0, and would, therefore, require 150 excess hours, a much higher value than on the machine which we picked.

This completes the scheduling of this very simple order pattern. As will be seen from the column on the right in our table, there are 115 hours excess over the "ideal machine time."

Index method, because of its simplicity, is often used in problems of this sort. It can be solved very quickly, with very little time or effort required in the solution. The method has shortcomings which make it useful only under special circumstances. For example, it is an informal method of solution, and approximates a best answer. The other three methods are formal, and proceed through a finite number of steps to the *best* answer.

However, if you want to include engineering time in your definition of what makes the best answer, very often the index method will fill the bill. In other words, if the cost of lost production time incurred by use of the index method, instead of one of the more complicated methods, costs you less than the extra engineering time it would take to set up and maintain, let's say a MODI solution, then the Index Method answer can be considered as the "best" answer.

Programming . . .
is done in this working area. Files contain information on operation times, setup and machine code numbers, and alternate methods. Control board shows cards with orders running on the various machines. The width of each card represents the amount of time required for the order to run. Because orders are not scheduled until the day they are to run, it is possible to take advantage of setup-time savings by putting an order on a machine where the least setup change is required. Only two or three minutes are needed to find the best machine for any given order. Inset shows Wilson Bauder, who handles Linear Programming calculations. Bauder has been working for SKF for 13 years, starting right after he graduated from a Philadelphia high school. He has had no further formal education. He has also worked as a clerk in planning and production control departments

SKF used the index method... gained 10% in screw-machine output

SKF Industries, Inc, gained 10% production in its automatic-screw-machine division by scheduling parts into machines using the Index Method of Linear Programming. Also, the company gets much better conformance to delivery schedules, and, when machines are scheduled to capacity, management can reject excess orders or warn that these orders cannot be made on time.

The Frankford plant makes inner and outer bearing races, of which there are about 18,000 different parts, 98% of which go through the screw-machine department. This department has 120 machines, from 1 to 7½-in. capacity, single- to 6-spindle. Total orders are for about 1¾ million pieces per month, with 60 to 70 orders on hand at any one time. About 85 new orders are received, of 50 to 100 hours per lot. This complex order pattern was greatly simplified by introduction of LP.

Production information

Daily reports tell how many pieces have been done, and spot those parts which are behind schedule. No parts are scheduled unless there is a specific machine on which to run them. The machine has been "set aside" for that particular job so all parts should run when planned. When this does not happen, management knows there is trouble afoot, and can take immediate steps to straighten out the situation. This "management by exception" frees the planning department from working on routine matters, which should take care of themselves. This result is typical of Linear Programming; once the method is set up, a great many problems which are a normal part of production planning disappear, and planners and engineers can work on jobs which require special handling.

The steps in setting up the SKF installation were quite similar to those at Mueller Brass, except that at SKF costs were combined with running times to get what was known as an "equalized machine hour" which brought both cost and time into the "index number." (The goal was least cost, while at Mueller Brass it was greatest quantity. As it turned out, quantity resulted at SKF, as well as lowest cost.)

Steps taken at SKF . . .
to process an order from the time it is received in the shop until it is put into the production cycle and excess hours (hours over "ideal time") are accounted for

The Programming Procedure for Assigning Orders to Machines to Minimize Costs

NEW SHOP ORDERS

Make a 4 x 6 white card for each new shop order to be scheduled. Card shows:

Shop Order No.	Machine Code
Part No.	Running Time
Stock O.D.	Set-up Time
Date Required	Total Machine Hours

On each card, compute the total machining time if job is done on the ideal machine code (the group of machines that will do the job in the fewest number of hours). Take time data from record file—add full set-up time to running time for that size order.

EXISTING ORDERS

Make a 4 x 6 buff card for each existing order which is already scheduled or being machined. Card contains information similar to white cards.

On each card, compute the remaining machining time to complete the order.

NOTE: FOR BEST RESULTS, RE-SHUFFLE ENTIRE SCHEDULE EACH WEEK

Sort cards representing all orders to be scheduled during period into three groups: inner races, outer races, and miscellaneous parts. This will make it easier to combine orders requiring the same set-up.

1. Arrange each group in order of increasing bar stock sizes.
2. Group like orders (those requiring the same set-up).

→ Make one composite card for each group of like orders. Compute new time to machine composite order with only one set-up.

Group orders according to ideal machine code for running the job.

Total the hours to be scheduled on each ideal machine code.

Determine the machining hours available in each code for the scheduling period. Use information from shop on number of machines, downtime, and total working time available.

→ Compare the total hours to be scheduled on each machine code with the available hours for machining in that code.

→ Codes with scheduled hours less than available hours are not overloaded. These cards can be set aside temporarily.

Codes where hours to be scheduled are more than available hours are overloaded. These cards are handled as follows:

1. Compute total time to machine each order on alternate machine codes where job can be performed. Total time equals running time for order plus full set-up time.
2. Multiply total hours by cost factor to obtain equalized hours for each alternate code.

1. Compute excess hours for each alternate code for each job. ("Excess hours" is alternate hours minus ideal hours.)
2. Divide excess hours by ideal hours to obtain an "index number" for each alternate. For example.

$$\frac{100 \text{ excess hours}}{400 \text{ ideal hours}} = .25, \text{ Index number}$$

$$\frac{200 \text{ excess hours}}{400 \text{ ideal hours}} = .50, \text{ Index number}$$

Shift orders from overloaded codes to codes that are not overloaded. Move first to codes with lowest Index numbers in order to minimize excess hours. Additional shifts may be made in order of increasing Index numbers. Look for ways to shift orders in double and triple shifts to obtain a schedule pattern that takes advantage of the most economical production facilities.

→ Compute the excess hours assigned to each code. Make up a summary sheet showing:

1. Order No.
2. Bearing No.
3. Part No.
4. Ideal Machine Code
5. Ideal Time
6. Assigned Code
7. Assigned Time
8. Excess Hours

1. Regroup all order cards according to most desirable codes for machine scheduling
2. Total the hours of machine loading for each machine code.

Hang each group of cards on a separate hook, one for each machine code.

Schedule orders from these card groups to maintain the delivery schedule required.

Prepare separate reports on the reasons for excess hours.

LP balances production and distribution costs...

One of the most profitable uses of LP is in balancing production and distribution costs to get maximum profit. To see how this works, let's look at a sample case which shows how this over-all planning problem is made easier with the programming approach.

The company we will look at is ECCO—The Eastern Cabinet Co—a fictitious maker of metal kitchen cabinets. ECCO has two plants—an old one in St Louis, and a newer, more efficient one in Pittsburgh.

Assume you are head of the profit-planning department, and have been asked to see whether LP can be used to plan and assign production of the company's two plants.

Distribution information

Your company does not have its own dealers or retail outlets, but sells to large department stores, mail-order chains, supply houses, and large private construction companies.

To remain competitive, the company absorbs the cost of freight into certain market areas ("freight equalization"), where necessary.

Production information

It's general knowledge in your company that the paint-spray department in each plant is the bottleneck department, limiting the amount of product shipped. These departments work five days, three shifts, while other departments work one shift, with occasional skeleton crews on a second shift.

Spray painting booths are conveyorized, with parts passing through the booths into ovens, then to shipping, where they are taken off hooks, packed, and shipped. This method is used to save storage space, but means that all parts for a particular cabinet must reach shipping at the same time.

The St Louis plant has three paint conveyors, and the Pittsburgh plant has two, all with different rates of speed, therefore, of production. There are eight cabinet sizes, each of which takes a different amount of hook space on the conveyor.

Production rate per hour of completed cabinets by conveyor line

Cab Size	PITTSBURGH		ST LOUIS		
	Line A-12" 120'/hour 120 hks/hr	Line B-12" 80'/hour 80 hks/hr	Line C-12" 60'/hour 60 hks/hr	Line D-12" 60'/hour 60 hks/hr	Line E-15" 120'/hour 120 hks/hr
W 1530	24	16	12	12	19 1/5
W 1830	20	13 1/3	10	10	16
W 2430	13 1/3	8 8/9	6 2/3	6 2/3	16
W 3030	13 1/3	8 8/9	6 2/3	6 2/3	10 2/3
W 3630	10	6 2/3	5	5	9 3/5
W 2418	21 9/11	14 6/11	10 10/11	10 10/11	19 1/5
W 3018	20	13 1/3	10	10	17 5/11
W 3618	15	10	7 1/2	7 1/2	12 4/5

Available conveyor time

Conveyor Line	Max Avail Time per Quarter	% Operative Time	Available Time Hours
Pittsburgh			
A	1560	96.0	1497.60
B	1560	87.5	1365.00
St Louis			
C	1560	85.5	1333.80
D	1560	95.0	1482.00
E	1560	89.3	1393.08
			7071.48

Standard cost per conveyor hour

	Line A	Line B	Line C	Line D	Line E
Dir Labor	14.00	11.50	13.00	13.00	15.00
Maint	2.00	2.00	4.00	4.00	2.00
Fuel	3.00	3.00	4.50	4.50	3.00
Paint, etc	5.00	4.50	3.00	3.00	4.00
Pack & Ship	8.75	7.00	7.00	7.00	8.50
Total	32.75	28.00	31.50	31.50	32.50

Standard costs per cabinet—Paint & Pack

Cabinet Size	PITTSBURGH		ST LOUIS		
	Line A	Line B	Line C	Line D	Line E
W 1530	1.365	1.750	2.625	2.625	1.693
W 1830	1.638	2.100	3.150	3.150	2.031
W 2430	2.456	3.150	4.725	4.725	2.031
W 3030	2.456	3.150	4.725	4.725	3.047
W 3630	3.275	4.200	6.300	6.300	3.386
W 2418	1.500	1.925	2.888	2.888	1.693
W 3018	1.638	2.100	3.150	3.150	1.862
W 3618	2.183	2.800	4.200	4.200	2.539

With this information, you are supposed to assign customer orders to get maximum profit, considering costs of both production and distribution.

This problem looks complicated and time-consuming, and, remembering how difficult even the easiest LP methods looked, it would seem to be unmanageable. But here is the important fact—it took just a week to find comparable information in an actual installation of very similar nature, and *the entire LP answer can be solved or re-solved in 50 minutes.* This means that if any one or more of these cost and production figures changes

A CASE STUDY

enough to warrant changing the assignment of work, it takes less than an hour to recompute the whole program, taking all the factors into account. The problem is solved with the "MODI" method, which you will see on the next pages.

Cabinet selling price

Cabinet Size	1530	1830	2430	3030	3630	2418	3018	3618
Selling Price	6.50	7.70	10.80	11.27	13.83	7.38	8.00	9.78
Stacey	6.00	7.00	9.80	10.10	12.50	6.75	7.20	8.90
Morris	6.00	7.00	9.80	10.10	12.50	6.75	7.20	8.90

Orders received by region for release and shipment in the second quarter

Orders Received Up To And Including January

WESTERN REGION		MID-WESTERN REGION	
CUSTOMER	ORDER	CUSTOMER	ORDER
CS Los Angeles	2000—W 3030	CS St Louis	2500—W 3030
CS Seattle	500—W 3018	JC Minneapolis	50—W 3630
SC Houston	1200—W 3030	CS Cleveland	500—W 3630
CS Houston	600—W 1530	CS Cleveland	500—W 1830
WG San Francisco	100—W 3030		
WG San Francisco	100—W 1530		
WG Dallas	500—W 3630		
WG Dallas	500—W 1830		
SOUTHERN REGION		**EASTERN REGION**	
AL New Orleans	250—W 3030	EM Baltimore	250—W 3030
AL New Orleans	250—W 3018	EM Baltimore	120—W 2418
CS Atlanta	500—W 3030	CS Philadelphia	100—W 3630
CS Atlanta	1500—W 3018	CS Philadelphia	450—W 3518
AL St Petersburgh	300—W 1530	MS Morristown	1000—W 3630
AL St Petersburgh	150—W 3030	MS Morristown	500—W 3018

Orders Received During February

WESTERN REGION		MID-WESTERN REGION	
WM Denver	240—W 3030	WG Kansas City	1400—W 3018
WM Los Angeles	620—W 3030	WG Detroit	500—W 3630
WM Los Angeles	100—W 3630	JC Minneapolis	50—W 3630
WM Los Angeles	920—W 3018	JC Minneapolis	40—W 1530
		JC Detroit	1000—W 3030
		JC Detroit	500—W 1530
SOUTHERN REGION		**EASTERN REGION**	
WG Atlanta	600—W 3630	CS Boston	1200—W 3030
WG Atlanta	200—W 3018	WG Pittsburgh	50—W 3630
AL Mobile	150—W 3030	WG Pittsburgh	50—W 1530
AL Mobile	300—W 1530	EM Wilmington	3600—W 3630
		SC Philadelphia	600—W 1530
		SC Philadelphia	2880—W 2418
		EM Baltimore	600—W 2418

Orders Received During March

WESTERN REGION		MID-WESTERN REGION	
CS Los Angeles	1000—W 3630	JC Minneapolis	100—W 3630
WM Denver	360—W 3030	JC Minneapolis	200—W 1530
WM Denver	2200—W 1830	JC Detroit	100—W 1530
WM Denver	1000—W 3630	JC Chicago	500—W 3030
WM Salem	500—W 3630	JC Chicago	525—W 1830
WM Salem	240—W 2418	JC Fort Wayne	800—W 3630
WM Portland	1100—W 3030		
SOUTHERN REGION		**EASTERN REGION**	
		WG Pittsburgh	200—W 3030
WG New Orleans	100—W 3630	EM Bridgeport	120—W 2418
WG New Orleans	650—W 1530	EM Bridgeport	180—W 1530
AL Birmingham	120—W 1530	EM Bridgeport	170—W 3030
AL Birmingham	110—W 3030	EM Trenton	2000—W 3630
AL Birmingham	330—W 3630	EM Trenton	2000—W 3018

MODI is the simplest formal method...

The MODI method is, today, the simplest of the *formal* methods for calculating a Linear Programming solution. Steps and solution are fixed, and lead directly to the best answer, while the Index method is an informal, visual-inspection technique. The success of the Index method depends somewhat on the skill of the clerk handling the information, while the success of the MODI method depends largely on the skill of the engineer who sets the problem up.

The problem shown on p 123 can be solved with the MODI method, with these steps:

DEMAND IN PIECES		
ORDER	A	200
	B	150
	C	400
	D	600
	E	420
	F	150

RATES OF PRODUCTION - PCS/HR				
MACH	I	II	III	IV
ORDER A	18	20	10	16
B	45	50	25	40
C	9	10	5	8
D	27	30	15	—
E	9	10	5	8
F	—	75	—	—
INDEX	.90	1.00	.50	.80

STD. MACHINE

ACCOUNTING COSTS - $/PIECE				
MACH	I	II	III	IV
ORDER A	2.50	2.00	4.00	3.00
B	1.20	1.00	1.70	1.50
C	0.65	0.60	0.70	0.80
D	4.00	3.00	4.50	—
E	3.00	2.60	3.20	3.40
F	—	1.80	—	

SELLING PRICE $/PIECE
5.10
2.00
1.50
6.80
4.00
3.00

AVAILABLE CAPACITY - STD MACHINE HRS					
	MAX HRS AVAIL	% UTIL	EFFECTIVE AVAIL HRS	INDEX	STD MACH HRS
I	40	0.950	38.0	0.90	34.20
II	40	0.97	38.8	1.00	*38.80
** III	80	0.800	64.0	0.50	32.00
IV	40	0.870	34.8	0.80	27.84
	TOTAL				*132.84

**OPERATES TWO SHIFTS

*TO BE ADJUSTED FOR ORDER F(2) 130.84

DEMAND IN STD MACHINE HRS	
A REQUIRES	10.0 STD MACH HRS
B	3.0
C	40.0
D	20.0
E	42.0
F	2.0

		PROFIT/STD MACHINE HR
A	I	2.60 × 20 = 52.00
	II	3.10 × 20 = 62.00
	III	1.10 × 20 = 22.00
	IV	2.10 × 20 = 42.00
B	I	0.80 × 50 = 40.00
	II	1.00 × 50 = 50.00
	III	0.30 × 50 = 15.00
	IV	0.50 × 50 = 25.00
C	I	0.85 × 10 = 8.50
	II	0.90 × 10 = 9.00
	III	0.50 × 10 = 5.00
	IV	0.80 × 10 = 8.00
D	I	2.80 × 30 = 84.00
	II	3.80 × 30 = 114.00
	III	2.30 × 30 = 69.00
E	I	1.00 × 10 = 10.00
	II	1.40 × 10 = 14.00
	III	0.80 × 10 = 8.00
	IV	0.60 × 10 = 6.00
F	II	1.20 × 75 = 90.00

To make the MODI method work at all, all information must be converted into common units. In transportation problems this is no problem, because shipments are expressed as tons of product, or some such expression, and distances are in miles, which can easily be converted into dollars. However, in most production problems, there are several kinds of products, and a number of different kinds of machines, so the information is not "homogeneous."

The critical step in setting up the MODI problem, then, is to express everything in terms which will lead to a solution. In our example, the key to success is the use of an "index number" (*not* the same index number as we saw in the "Index Method"), to express the effectiveness of one machine, as compared to another.

Here are the things to do to find the index number and make it work for you:

- **By inspection,** select a machine which is most effective, to which all other machines will be compared. In our case, this will be machine 2, which

has the highest rates on all the parts. This is given an index number of 1.00.

• **Compare** each of the other machines to machine 2, to find what number will express the relative efficiency of each machine, compared to the standard. This can usually be done by comparing "weighted averages" of production rates on the various parts on the two machines. It will usually be necessary to do a little juggling to make sure the resulting index is appropriate. Also, there may be cases where there is no direct comparison between two machines. Then the engineer will have to find a roundabout way to make the comparison. There are two ways: First, you can compare both machines to a third machine. This is a little like saying Yale beat Harvard by 6 points, and Harvard beat Columbia by 7 points, so Yale should beat Columbia by 13 points. Although this is an approximation, it is usually close to the truth, and if it makes the method applicable, it is certainly better than no approximation at all.

The other case, where there are no such comparison paths, it is necessary to estimate the ratio more or less "by eye." When this has been done, and a solution found, it is possible, by going back and recomputing the answer, to judge the accuracy.

• Now that we have "index numbers" for the machines, the next step is to make the conversion. Standard available hours are found by multiplying raw hours by machine utilization, which is common practice. Then the effective available time is multiplied by the index number, to get "Standard Machine Hours."

• Demand is also expressed in "standard machine hours" by dividing the actual demand by the *rate of production on the standard machine.*

• Profit is expressed as "dollars per standard machine hour" by multiplying accounting costs per piece by *rate of production on the standard machine.*

Now we can set up the solution matrix, with the data in the form into which we have just converted. Starting with the standard LP matrix, profits per standard machine hour are entered in the small boxes in their appropriate squares. To make fewer steps in the final calculations, machines are listed in decreasing order of profit, and parts are arranged in decreasing order of profit.

A formal mathematical requirement of the method, is that capacity must equal demand, so we have to add a "dummy" product to take up slack time. This product has zero profit, so it will not enter the solution, but it must be listed to perform the calculations. In case we had had insufficient capacity, we could have added a "purchase" row, to represent a vendor's machine. Profit values would be found by subtracting cost from profit, which in this case would be taking purchase price from selling price.

We can begin assigning orders, starting at the upper left hand corner, filling capacity and order requirements. Part D requires 20 hr, and there are 36.8 hr available on machine 2. Square D2 then gets an order of 20 hr, leaving 16.8 hr available on machine 2. Part of these 16.8 hr are used to work parts A, and B. The remaining 3.8 hr are used to start part E, which is finished on machine 1. The rest of the orders are assigned in the same way, giving this result:

Program...1

	D	A	B	E	C	DUMMY	Std Mach Hrs Avail	PROFIT ON PROGRAM...1
COL / ROW	114.00	62.00	50.00	14.00	16.00	11.00		20 × 114.00 = 2280.00
II 0	114.00 (20)	62.00 (16)	50.00 (3)	14.00 (3.8)	16.00	0	36.80	16 × 62.00 = 620.00
I -4.00	84.00	52.00	46.00	10.00 (34.2)	8.00	0	54.20	3 × 50.00 = 150.00
IV -8.00		42.00	38.00	6.00 (6)	8.00 (23.84)	0	27.84	3.8 × 14.00 = 53.20
III -11.00	69.00	22.00	15.00	-8.00 (3.80)	+5.00 (16.16)		32.00	34.2 × 10.00 = 342.00
STD MACH HRS REQ	20.0	10.0	3.0	42.0	40.0	15.84	130.84 / 130.84	4 × 6.00 = 24.00
								23.84 × 8.00 = 190.72
								16.16 × 5.00 = 80.80
								15.84 × 0 = 0.00
								TOTAL PROFIT = 5740.72

Note that these values are circled. This is done to separate these values from other numbers used in the calculations.

The next step is to make small squares in the row and column squares of the table, and insert the profit values as given in the statement of the problem. Now we are ready to begin the formal mathematics which will lead us to a solution.

The first step is to fill in the row value table; that is to say, the vertical table alongside machine numbers. The row value for Machine 2 is arbitrarily picked as zero. The only reason we use zero instead of any other number is that it makes the calculations easier. Now we are going to compute profit values to put in the "row value" list.

The rule we follow is this:

The sum of row and column values of boxes which have orders assigned to them must equal the profit value shown in these boxes. In other words, if we start with the upper left-hand box, we find a column value of 114.00, because the row value is zero, and the row and column values must equal 114.00—the profit value of square D2. In the same way, the column of A is equal to 62.00, the column value of column B is 50.00, and for column E, is 14.00. Because column E has a value of 14.00 and square E1 has a profit value of 10.00, the row value for machine 1 is 10.00 – 14.00, or – 4.00.

With this value we can go to row 4. Square E4 has a value of 6.00, and column E has a value of 14.00, so the value for row 4 is 6.00 – 14.00, or – 8.00.

We can work around the table this way, finding values for all the rows and columns. (There is a mathematical rule that says for a matrix of R rows and C columns, there must be at least (R + C – 1) entries in the first program.)

These values appear in "Program 1."

The next step is to go through the mathematical calculations to find out where better assignments can be made (if there are any). This is done by comparing the sum of row and column values to the profit value, which is more or less working backward from the last step in finding the row and column values. *If the sum of the values is greater than the profit, it shows that a greater profit is obtained by leaving the square vacant. If the row and column values are less than the profit value, it means the profit will be increased by moving to the vacant*

square, to take advantage of the higher profit.

Starting at the upper left-hand corner and working outward and downward, as soon as the first square is reached in which the greater profit can be obtained, stop the calculations and fill that box. (It would be possible to evaluate all the open squares, to find the greatest profit increase, but this isn't necessary, because the arrangement of the rows and columns is such that generally speaking the upper left-hand squares will be the squares of greatest possible profit.)

For example, at Machine 1, Order D, row and column values equal 110.00, which is greater than the 84.00 in the square. Therefore, profit will not be increased by using this capacity. In going through these calculations, we come to Machine 3, order E, where row and column values equal 3.00. Profit for that box is 8.00. **This means we can begin to load this square to take advantage of the extra profit.**

Here are the steps to find the amount of load to put in the square:

Starting with the profitable box—E-3 in our case —move left or right to the first circled box value, in such a way that you will be able to move up or down to another circled square.

Then move up or down to the next circled square, being sure that when you stop at a circled square, you can move right or left to another circled value.

Proceed in this way through the most direct route from the profitable box back to circled values, returning to the profitable box. In our case we move right to C3, up to C4, to the left to E4, and back to E3.

Having gone through these steps, assign alternating + and – signs to the boxes which we used as turning points, starting at the "profit-making" box with a – sign. C3 will be +, C4 will be –, E4 will be + and E3 will be –. This "track" is one of the "standard maneuvers" of Linear Programming solutions, and is found in both Simplex and Distribution, as well as the MODI method. Having gone through these steps, find the box with the + sign which has the smallest circled value, which, in our case, is E4. Add the amount of the order in E4 (4) to the boxes with a – sign, and subtract it from the boxes with a + sign. This will change C4 to 27.84 hr, C3 to 12.16 hr; it will remove the value from E4, and will add 4 to E3. The effect of this change is, of course, to take 4 hr away from Machine 4 on Part E, and to use those 4 hr on Machine 3 to do Part E.

Program...2

	D	A	B	E	C	DUMMY	STD MACH HRS AVAL
COL / ROW	114.00	62.00	50.00	14.00	16.00	11.00	
II 0	114.00 (20.0)	62.00 (10.0)	50.00 (3.0)	14.00 (3.8)	9.00	0	36.80
I -4.00	84.00	53.00	46.00	10.00 (26.2)	8.50	0	34.20
III -5.88		42.00	25.00	6.00	8.00 (27.84)	0	27.84
III -6.00	69.00	32.00	15.00	8.00	5.00 (12.16)	0 (15.84)	32.00
STD MACH HRS REQ	20.0	10.0	3.0	42.0	40.0	15.84	130.84 130.84

TOTAL PROFIT $3760.32
AN IMPROVEMENT OF $20.00

Now it is necessary to recompute row and column values for the new program. We go through the same steps as before, including transferring the order:

Program...3

	D	A	B	E	C	DUMMY	STD MAC HRS AVA
COL / ROW	114.00	62.00	50.00	14.00	12.50	6.00	
II 0	114.00 (20.0)	62.00 (10.0)	50.00 (3.0)	14.00 (3.8)	9.00	0	36.80
I -4.00	84.00	53.00	46.00	10.00 (42.04)	8.50 (12.16)	0	34.20
III -4.51		42.00	25.00	6.00	8.00 (27.84)	0	27.84
III -6.00	69.00	32.00	15.00	8.00 (16.16)	5.00	0 (15.84)	32.00
STD MAC HRS REQ	20.0	10.0	3.0	42.0	40.0	15.84	130.84 130.84

TOTAL PROFIT $3778.96
AN IMPROVEMENT OF $18.24

This is the best possible program, which can be found by computing row and column values as before, and looking for a square which has a lower value than the profit box. Because there are none, *this program cannot be improved on.* That is the signal which tells us we have fulfilled the objective.

Interpretation of Best Program...

ORDER	MACH	NO. STD HRS	INDEX	NO. ACTUAL MACH HRS	PIECES / HRS	PIECES SCHEDULED	PIECES REQUIRED
A	II	10.0	1.00	10.00	20	200	200
B	II	3.0	1.00	3.00	50	150	150
C	I	12.16	0.90	13.51	9	121.6 (400)	400
	III	27.84	0.80	34.80	8	278.4	
D	II	20.0	1.00	20.00	30	600	600
E	I	22.04	0.90	24.49	9	220.4	420
	II	3.8	1.00	3.80	10	38 (420)	
	III	16.16	0.50	32.32	5	161.6	
F	II	2.0	1.00	2.00	75	150	150

MACHINE LOAD - ACTUAL HOURS				
	I	II	III	III
A		10.00		
B		3.00		
C	13.51			34.80
D		20.00		
E	24.49	3.80	32.32	
F		2.00		
TOTAL	38.00	38.80	32.32	34.80
AVAIL HRS	38.00	38.80	64.00	34.80

1.. ALL REQUIREMENTS HAVE BEEN MET
2.. ORDERS 'C' AND 'E' ARE SPLIT AND RUN ON SEVERAL DIFFERENT MACHINES
3.. MACHINE 3 IS UNLOADED BY 64.00-32.32 = 31.68 HRS
4.. POSIBLE TO DROP ONE OF THE TWO SHIFTS (40.0 x 0.80 = 32.0 EFFECTIVE HOURS AVAILABLE)

This procedure seems long and complicated at first glance, but this is not the case. For example, an experienced engineer can compute the best answer to the MODI problem of the ECCO Co in less than an hour, once the problem has been set up.

The advantages of the MODI method, compared to Simplex and Distribution methods, are: the MODI method can be worked out much more quickly, with fewer computations, and using only one "matrix," reducing the chance of error. Also, most MODI problems can be worked out manually.

Disadvantage is that the MODI method can only be used when the problem data are established in the same units.

Other methods... DISTRIBUTION, SIMPLEX, and RATIO ANALYSIS

The Distribution method is, as its name implies, suited mainly to transportation problems. It is very similar to the MODI method, except for minor computational differences. Two basic tables of information are used, instead of one, and computation time is somewhat longer. Results of both methods are essentially the same, so the Distribution method is largely replaced by the simpler and quicker MODI method, for standard production planning.

Simplex

The Simplex method is the "grandfather" of Linear Programming methods. It is basic, general, and very hard to manipulate. The Simplex matrix uses raw information instead of data that has been expressed in common units. Complicated Simplex problems require the use of high-speed computers —not because of the nature of the mathematics, but simply as a result of the bulk of arithmetic involved.

The Simplex method is rarely used in day-to-day practice, except as an analysis tool, to show management what the best possible answer is to a particular problem. It is then usually replaced by one of the simplified methods after the problem has been set up.

Ratio analysis

The Ratio Analysis method is so new that it has not yet been tried in an actual installation. From preliminary results, it seems like Ratio Analysis will be able to replace the more cumbersome Simplex in many cases, yielding a result which is just as accurate but much easier to handle.

* * * *

Linear Programming works in two broad areas—scheduling and planning.

Scheduling

When parts aren't moving through production fast enough, when delivery promises aren't being met, or lead time is too long, when there is too much inventory at certain machine groups, when overtime and setup time in one department are out of proportion to the rest of the plant, the chances are that a bottleneck exists which could be opened up with the scheduling methods of LP. (The Index Method is usually used here.)

In a multi-plant situation, though, scheduling should not be done until after "over-all planning," to make sure that orders are being done in the right plant.

Over-all planning

When a number of different-cost methods exist, and over-all goals are not well established, the LP "planning" methods will often help find the best program of production. The true objective is often unknown, because management has no standard of "most-profitable" or "least-cost" programs.

This points up an interesting and powerful feature of Linear Programming. In any business situation, there are a number of related problems that are interdependent, the solutions to which depend on what management wants out of its facilities.

For example, most parts can be made in several ways, on different types of machines, at different production rates and costs. The purpose of making the parts may be to make the most profit with a given number of hours of work; to make the most parts in a given time; to make a given number of pieces in the shortest time; and so on.

These goals are not identical, and usually require different programs for their fulfillment.

Also, there are other goals besides making the highest immediate profit, making at least cost, or making the greatest number of parts. Such things as customer service, rush orders which break into the production plan, prestige products, and products made at a loss in the hope of future markets—all these cost money (lost profit).

Linear Programming cannot tell which of these is the best course of action. That is the duty of management to decide, but LP can help a great deal by showing the cost of pursuing goals which cause a loss of income.

How to start planning

The common starting points, when management is not sure of what standard to apply to the problem, are a *given product line* and *given facilities*. The "first" LP solution takes these two sets of facts and works out a most profitable program, assuming the company can sell everything it makes. This gives a certain profit program.

Then management has a clear view of the best program and, knowing that program, can direct future plans toward whatever goals are chosen.

The company can redirect sales effort to sell more of the high-profit items, or it can revamp its production facilities, to make existing sales pattern as profitable as possible.

Also, at each stage of development of plans toward the best program, Linear Programming can give answers about what is the next move to make, what the effect of changed conditions would be, and what it would mean to change the goals.

Mechanics of setting up LP

Before any program can be solved, a great deal of attention must be paid to gathering information and establishing the relationship of the various pieces of this information. This is one of the most revealing steps in the LP procedure, and is often as valuable

as the final solution. This is what is meant by the "LP approach."

To get enough facts from which to work, part costs, machine times and costs, profits per piece, distribution and sales costs, and many other such things must be examined, item by item. Thus management is forced to focus attention on things which have been neglected under the pressure of time, and which have been "taking care of themselves."

When the reports are in

When information is gathered, the next thing to do is to set up a "matrix," which is nothing more than an orderly table of information.

This matrix is the basic work-form which is used in all the methods. In two of the "matrix methods" (MODI and Distribution), the totals of rows (horizontal, or capacity statements) and columns (vertical, or requirement statements) must be equal. In other words, capacity must equal demand. This is a formal mathematical requirement of the method. If the two don't add up, dummy products (with arbitrarily high costs or zero profit) or dummy capacity (a "purchase" column, representing a vendor's capacity) can be added to the matrix to make the row and column totals equal.

Another important requirement of the MODI and Distribution methods is that all values must be expressed in comparable units. If part costs are expressed in dollars, then machine costs must be expressed as dollars per standard machine hour, and profit will be in dollars. In other words, you have to convert everything to "apples." With the Simplex method, you can mix "apples" (hours), "oranges" (dollars), and even "peaches" (number of pieces), if you want to. These are formal mathematical requirements of the methods.

Linearity

Nothing has been said yet about why the techniques being described here are called "Linear" Programming. The reason is that the relationships between the variables must be a linear or first-degree equation. For example, machine capacity can be expressed by the equation:

$$420 = 6A + 4B + C$$

This is a linear equation, which might represent the number of pieces of A (at 6 hr per part), B (at 4 hr per part), and C (at 1 hr per part) you can get out of a machine which can run 420 standard hours.

Although few production situations are truly linear, a great many can be made to approximate linearity with a few simple devices.

One way is to plot information on a graph, and draw a line of "least squares" through the points resulting, assuming then that all points fall on the line.

There are other similar devices.

Quality of the information

Because Linear Programming uses large quantities of information, there is often a question about how accurate the information has to be for the method to be effective. The answer is that regardless of the quality of data, as long as it is data that has been used for a normal production planning setup, the chances are very high that the same figures treated according to LP principles will show a marked improvement, because LP methods are more effective. In cases where "fudge-factors" are included in the production planning, these stray factors will be picked up as the LP and standard plans for a given installation are compared.

Future trends

There are two broad areas into which Linear Programming will probably expand. First, there is a great deal of work to be done along the lines we can already follow, with methods that have been worked out and successfully applied.

For example, case histories show here how some companies are pioneering in using current techniques. The ECCO study, which was very similar to an actual installation we have worked on, is just the first step in balancing distribution and manufacturing costs.

Also, the employment-leveling buy-make solution indicated in the opening pages of this report is the first such application that we know of. Pressure of unions for a guaranteed annual wage will make such attempts at leveling employment much more common in the future.

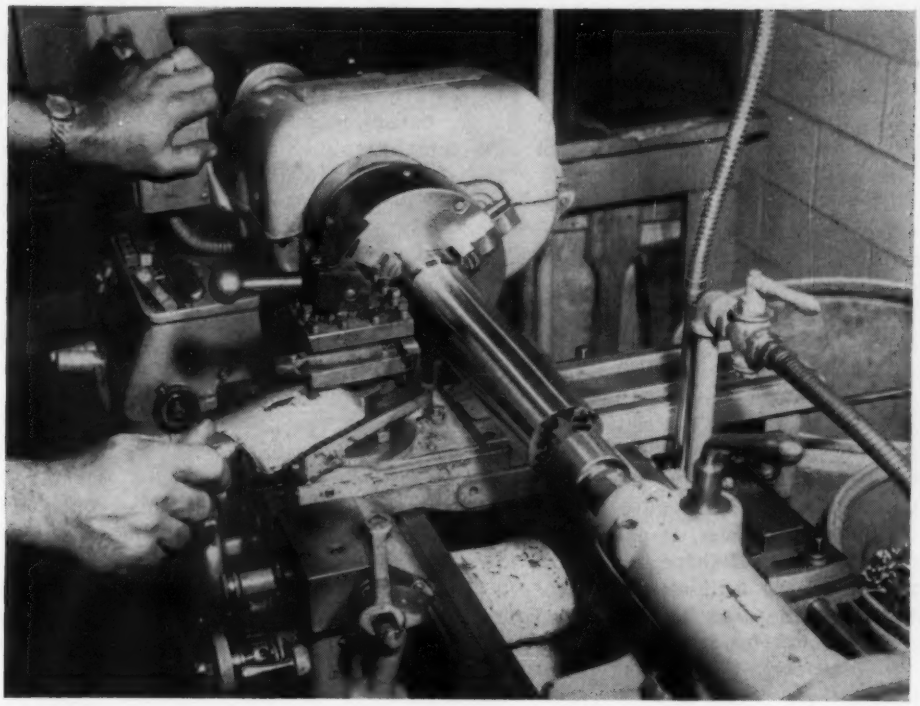
Also, present methods will do a great deal in helping management to plan such things as where to locate warehouses for least distribution cost; how big to make these warehouses; how to set up sales incentives to take advantage of high-profit items in the product-line; planning new products, for maximum profit, output, or some other goal; whether to make or purchase various products (we saw this in the examples of this report); and balancing inventory and sales costs.

In the long run, too, it will probably turn out that Linear Programming will become just a specialized case of the more general technique of "Mathematical Programming," which will be able to handle nonlinear situations. For example, work is already being done in several places on "quadratic programming" in which quadratic equations are set up to express the problem. Then these equations are differentiated, and the resulting linear equations are treated more or less as you saw here.

This is a great step forward, because there are certain costs which just do not behave in a linear fashion, such as inventory costs.

These improvements in methods will be very important in broadening the possible scope of the techniques. The most likely move will then be in the direction of "management planning," in which effects of future price changes, costs, and shipping and inventory costs will be subject to analysis.

One thing should be made clear, though. Linear Programming is not in any sense a crystal ball. It does not take the place of judgment, and it does not make predictions by itself. Management must make the decisions, and then study the effect of such decisions on the future of the company.



TURNING TEST on bar of MST 3A1-5Cr titanium alloy. Test bars were 18 x 3-in. dia

how to

Machine 3A1-5Cr titanium alloy

MST 3A1-5Cr is the strongest titanium alloy available in production quantities. This titanium-aluminum-chromium alloy has typical properties of 155,000 psi ultimate, 145,000 psi yield, and 15% elongation in 2 in. Produced by double-melting, carbon content is held below 0.1% which contributes to machinability. Tests and studies of this alloy by Metcut are the basis for these machining recommendations

NORMAN ZLATIN, partner, METCUT RESEARCH ASSOCIATES, CINCINNATI, OHIO

Machining studies were made on MST 3Al-5Cr double-melted (low carbon) titanium alloy. The alloy, taken from Heat 20279, averaged 340 Bhn, ranging from 330 to 350 Bhn. The higher hardness was found in areas just under the skin. Tests by Metcut included turning, drilling and tapping, and milling and sawing, but not grinding or reaming.

Tool life in all machining operations is dependent on rigid machine setups, use of a good coolant, sharp and proper tools, slow speeds and heavy feeds. Sharp tools are particularly important — as the tool wears, galling and seizing increase and hasten tool failure.

TURNING

Except for the relatively low cutting speeds, commercially pure and alloy titanium can be turned with little difficulty. Carbide, cast-alloy, and HSS tools are all satisfactory for turning titanium; the difference being that the cutting speed decreases in the order listed for equivalent tool life.

The "straight" tungsten-carbide grades of standard designations such as Carboloy 883, Firthite HA, Kennametal K6, and numerous other similar types, give the best results. Cobalt high-speed steels appear to be the best of the many types available. Cast-alloy tools, such as Rexalloy, Stellite, and Tantung, may be chosen when carbide is not available and when the cheaper high-speed steels are not satisfactory.

Water-base cutting fluids, such as soluble oils or chemical-type fluids are recommended. In high-speed turning operations, lubrication is less critical than keeping the tool workface cool.

Surface finish in machining titanium is good. Maintaining sharp tools is particularly important in turning operations. A nick or flank wearland on a tool promotes galling and seizing of chips which in turn increase temperature and cause rapid tool failure.

MILLING

Milling of titanium is a more difficult operation than turning. The problem is aggravated by the nature of the milling operation. The cutter mills only part of each revolution and during the part of the revolution that it does not cut, the

titanium chip remains tightly welded to the cutter edge. As the chip is knocked off at the start of the next machining portion of the revolution, the cutting edge of the tool usually chips away and the tool fails rapidly.

This problem can be alleviated to a great extent by employing climb milling instead of conventional. In this way, the cutter is machining the thinnest portion of the chip as it leaves the cut. Thus the area of contact between chip and tool is at a minimum when the chip is knocked off at the start of the next machining portion of the revolution, and there is less danger of chipping the tool.

Caution, however, is advised in climb milling. If there is any lost motion in the feed mechanism of the table, the work will be pulled into the cutter, damaging the cutter or work.

For slab milling, the work feed should move in the same direction as the cutting teeth. For face milling the teeth should emerge from the cut in the same direction as the work is fed.

The cutting edge usually fails because of chipping when milling titanium. Results are thus often less satisfactory with carbide tools than with cast-alloy tools. An increase in cutting speeds of 20 to 30% for carbide tools over cast-alloy tools, does not always compensate for the additional grinding costs. Consequently, it is advisable to try both cast alloy and carbide tools to determine the better of the two for each milling job.

Note the size of the relief angle required on milling cutters for titanium alloys (see table). The most satisfactory relief angles are appreciably greater than those usually used for steel. A relief angle of 11 to 12° is recommended —higher relief angles give rise to chipping of the cutting edge and lower relief angles lead to smearing.

As in turning, water-base cutting fluids are satisfactory.

DRILLING

Successful drilling can be accomplished with ordinary high-speed steel drills. One of the most important factors in drilling titanium is the length of the unsupported section of the drill. This portion should be no longer than necessary to drill the required depth of hole and still allow the chips to flow unhampered through the flutes and out of the hole.

Chip removal is one of the principal problems, particularly when the drill becomes dull. The appearance of the chip is often an indication of the sharpness of the drill. With a sharp drill the chips usually curl; as the drill wears the chips become straighter and thicker and begin to crowd the flutes.

In drilling titanium, drill failures occur not only as a result of wear on the lip of the drill but also because of galling or smearing of titanium on the margin of the drill. Hence in resharpening a drill, the condition of the margin of the drill should also be examined.

In deep-hole drilling, intermittent drilling is helpful. That is, the drill is removed from the hole from time to time during the drilling of one hole to remove chips.

High-speed-steel drills should operate at a cutting speed of 50 to 60 sfpm for commercially pure titanium and 30 to 50 sfpm for alloy grades. Feeds are 0.005 to 0.009 ipr for drills of ¼ to ½ in. dia, and 0.002 to 0.005 ipr for drills of smaller size.

Point angles should be 90° for drills about ¼-in. dia, and 140° for drills ⅛-in. dia or less. For any particular setup, drills of 90, 118, and 140° point angles should be tried. The helix of the drill used will influence the magnitude of the point angle.

Helix angles should be 28 to 35°,

Suggested speeds and feeds for turning titanium

	CARBIDE	HSS	CAST ALLOY
Commercially pure titanium*			
Cutting speed, sfpm	300-320	150-170	170-200
Feed, ipr	0.008-0.015	0.004-0.007	0.005-0.010
3A1-5Cr Titanium Alloy			
Cutting speed, sfpm	120-160	30-60	50-80
Feed, ipr	0.008-0.015	0.004-0.007	0.005-0.010

Based on MST-Grade III

Suggested tool angles for titanium

	CARBIDE	HSS	CAST ALLOY
Back rake,°	0	+5	+5
Side rake,°	6	5-15	5-15
Side cutting edge angle,°	6	5-15	5-15
End cutting edge angle,°	6	5	5
Relief,°	6	5	5
Nose radius, in.	0.040	0.010	0.005-0.010

Suggested speeds and feeds for milling titanium

	CARBIDE	CAST ALLOY
Commercially pure titanium*		
Milling speed, sfpm	160-180	120-140
Feed, ipt	0.004-0.008	0.004-0.008
3A1-5Cr Titanium Alloy		
Milling speed, sfpm	80-120	80-100
Feed, ipt	0.004-0.008	0.004-0.008

Based on MST-Grade III

Suggested tool angles for face milling titanium

	CARBIDE	CAST ALLOY
Axial rake,°	0	0
Radial rake,°	−10	0
Corner angle,°	60	30
End cutting-edge angle,°	6	6
Relief,°	12	12

and lip relief should be 10 to 12°. Cutting fluid should be an oil containing highly active additions, such as sulfurized oils. Screw machine or stud drills are recommended.

TAPPING

Tapping titanium is one of the more difficult machining operations. Most of the success in tapping has been with a 65% thread. Chip removal is one of the serious problems. However, in tapping through holes this problem is simplified by using a gun-type tap—the chips are then pushed ahead of the tap.

Another problem is the smear of titanium on the land of the tap, thereby resulting in freezing or binding of the tap in the hole. An active cutting oil such as a sulfurized and chlorinated oil is helpful.

In order to get a tap that has the minimum deflection, two-fluted taps are recommended in sizes under ¼-20, and three-fluted taps in larger sizes. Relieving the land is often beneficial.

Cutting speed should be 40 to 50 sfpm for commercially pure titanium, and 20 to 30 sfpm for the alloy grades.

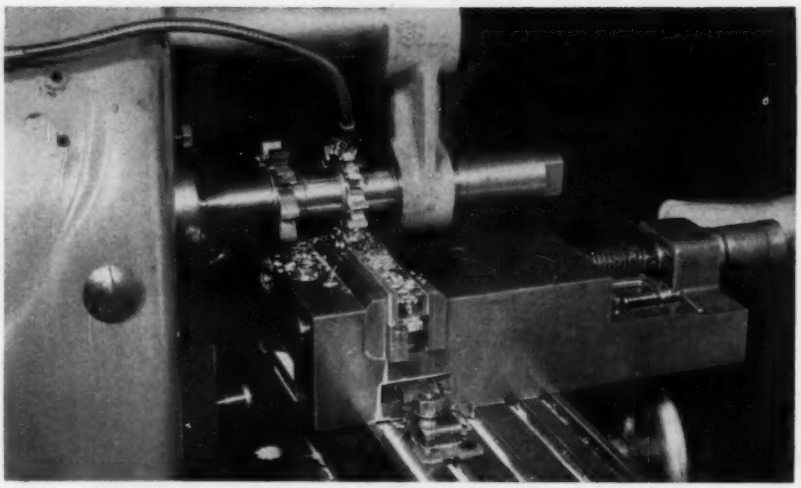
HACKSAWING

Difficulties encountered in hacksawing of titanium alloys parallel those found in other machining operations. However, several definite trends have been noted. Almost all reports stress using a saw which is in excellent condition and is equipped with positive feed.

Oils with sulfur and chlorine additives give the most satisfactory results. Speeds and feeds required depend on the type of alloy and the hardness involved. Alloys in a range around 300 Bhn can be cut at speeds of 60 to 70 strokes per min, and feeds of 0.012 in. per stroke. Fairly coarse pitched high-speed steel blades, 4 to 6 teeth per in., are recommended. Blade tension should be high.

GRINDING

Proper choice of grinding fluid, abrasive wheel and low wheel speeds can expedite this phase of machining. Formerly, grinding met with difficulties because of the rate at which the metal wore away the wheel. Evaluation of this operation has been made by The Norton Co (*AM*—Nov 10, '52, p 135), and evidence tends to indicate that titanium wears abrasive grain by a surface reaction.



MILLING TEST on rectangular bar of commercially pure titanium

The procedure is to use considerably lower wheel speeds than in conventional grinding of steels. Indications are that titanium can be ground more easily than high-speed steels, but not as easily as carbon tool steels.

Grinding fluids have a marked effect on the grinding ratio. The nitrite-amine rust inhibitors such as International Chemical Co compound No. 47LS, Socony-Vacuum rust inhibitor A, and Production Specialties, Inc, Rustlick GT give the best over-all results. Sulfurized-chlorinated oils also are satisfactory but not as economical.

Because most production facilities have been set for higher grinding speeds, this problem must be solved before grinding of titanium will be improved.

Surface grind with a wheel speed of 1500 sfpm. Alumina vitrified bond wheels of types such as Carborundum's C3A203-N-B5, A303-0-B5, or DA46-K9-V20, or Norton's 32A60-M8VBE, or 32A80-K8VBE, have proved satisfactory for surface grinding.

Table feeds of 400 to 500 ipm with down feed of 0.001 in. maximum per pass are suitable with 0.05 in. cross feed for the highest grinding ratio normally attainable.

Precision grinding and internal grinding recommendations are generally the same. Low wheel speeds, somewhat below 1800 sfpm should be used. Typical recommended wheels are 32A46-J8VBE and 32A60-M8VBE with work speeds of 40 sfpm and feeds of 0.002 in. with good grades of soluble oils.

REAMING

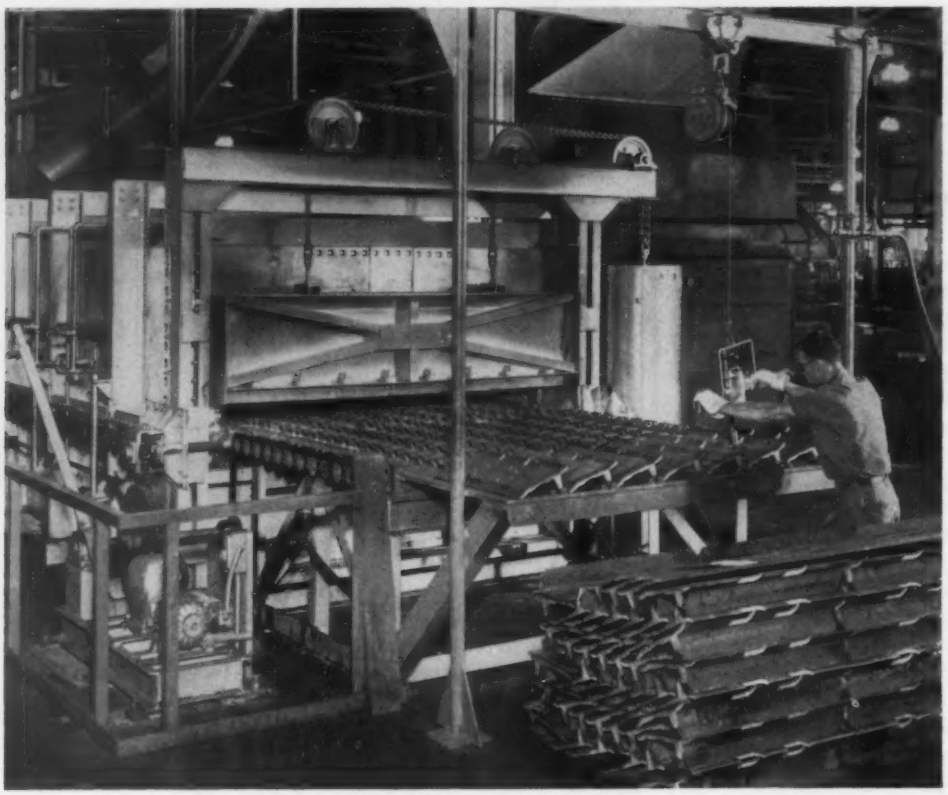
It is advisable to use carbide tips for longer life. Spiral-fluted reamers produce a better finished hole than the straight flute. With the carbide-tipped reamers, speeds of about 40 to 200 sfpm and feeds of 0.005 to 0.008 in. are satisfactory. Feeds should increase in proportion to the size of the hole. However, removal of larger amounts lessens the degree of concentricity.

ABRASIVE SAWING

Wet-abrasive cutting should be considered in cutting off bars of titanium alloy. The oscillating abrasive wheel does a satisfactory job on 3-in.-dia bars and smaller. In this method, the abrasive wheel is oscillated as it is fed downward.

On bars larger than 3-in. dia, rotating the bar as it is being abrasively cut is very helpful. A cutting fluid such as a water-base cutting fluid should be used.

Wheel speed should be about 7000 sfpm. Wheels such as Allison C60-N-RW3 or C90-NRL are recommended. The rate of cutting should be about 3 sq in. per min.



HARDENING FURNACE IS LOADED at powered-roller table, where operator deburrs drilled holes while waiting for conveyor to cycle. Track shoes up to 4 ft long and loaded eight across the conveyor are heated to 1550F in 45 to 60 min. Surface Combustion furnace will handle 5 tons of steel per hr

Cleaning, cooling make all the difference in oil quenching system

ROY F KERN, metallurgist, ALLIS-CHALMERS MFG CO, SPRINGFLELD, ILL.

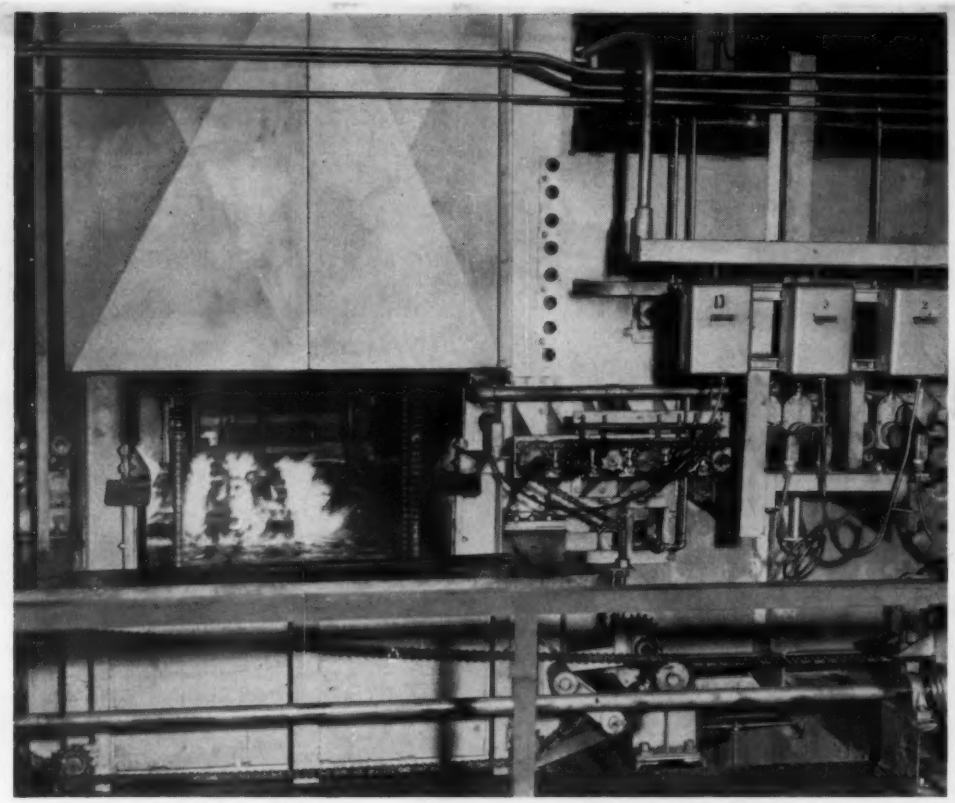
A really uptodate heat-treating setup can save major amounts of cash by making less oil do more work. Case in point is AC's Springfield Works, where rolled track shoes for crawler tractors are hardened and drawn. Material is AISI 1045 steel, and the load is from 7000 to 10,000 lb per hr.

The system is 105 ft long and has seven parts:

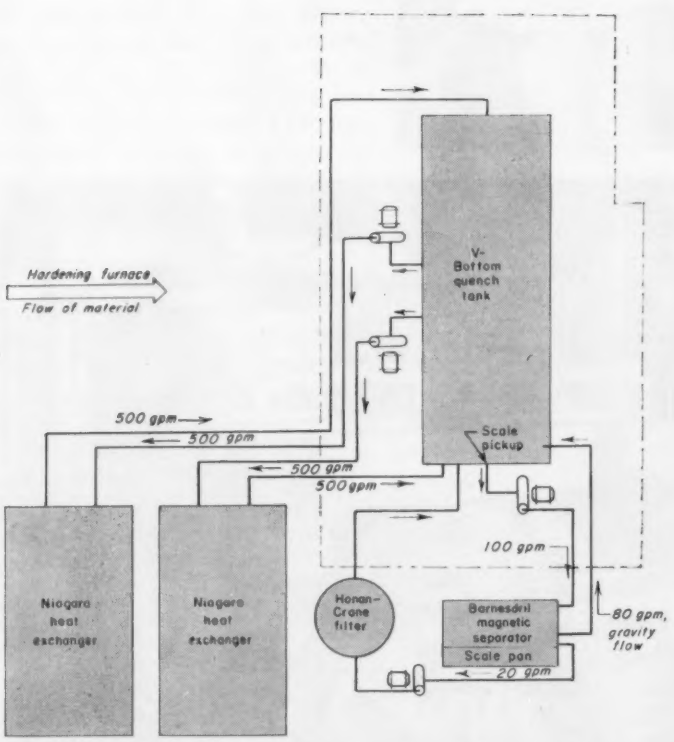
1. A 78-in. powered-roller loading table that feeds the gas-fired hardening furnace automatically.
2. A 30-ft roller-hearth Surface Combustion furnace with adjustable speed.
3. Automatic quenching unit with power-operated rack that takes shoes from the furnace rollers, dunks them in the oil quench tank automatically for 80 to 90 sec, then returns them to hearth level and lets them continue.
4. An 8-ft roller drain table that runs oil drippings from the shoes back to the tank.
5. An 8-ft alkaline spray-washing unit that removes oil residue.
6. A 34-ft roller-hearth Surface Combustion draw furnace, gas-fired and recirculating, that heats the shoes to 750F in a cycle 45 to 75 min long.
7. A 6-ft water-spray roller table that cools the shoes so they can be handled without gloves.

The quenching unit works automatically as a load of shoes rolls onto the last 4-ft roller section of the hardening-furnace hearth. Photoelectric cells actuate switches that move the load by turning the rollers, and the shoes are quenched when a limit switch in the elevating mechanism is depressed by the load. The next batch of shoes trips the photoelectric circuit, and the load is raised and the shoes unloaded automatically to the drain table.

The quenching system (see photos and drawing) is a large step beyond an older system, still in use, that uses 6500 gal of oil to quench 2000 lb of track shoes per hr. One of the big eliminations of the new system is a periodic cleanup, which had to be done on weekends and cost time-and-a-half for 40 man-hours. The new system has not required draining and cleaning in its first 18 months of operation.



BACK END OF FURNACE has photoelectric cells mounted against windows (right, wired to switch boxes above) to control quenching and subsequent operations. Direction of flow in this photo is right to left. Last 4-ft roller section in furnace is independently powered, and controlled by photocells to speed load of shoes onto quenching rack



QUENCHING IS EFFICIENT BECAUSE oil circulates constantly through coolers and separators. Tank holds 3350 gal of 100-sec-Saybolt oil, which is pumped to the two Model 4485 Niagara coolers at 500 gph. Older system, with 1/5 capacity, uses 6500 gal of oil

HOW MUCH IN SAVINGS...?

Comparing this new setup with an older track-shoe-hardening line long in existence, Allis-Chalmers engineers come up with several advantages:

- **Most quenching systems use at least 1, possibly 2 or 3, gal of oil per lb of steel quenched per hr. This one uses 0.335 gal; and makeup oil added to the system averages only a gal per 1600 lb of steel quenched.**
- **The older quenching line must be cleaned after draining every six months, requiring 40 man-hr at time-and-a-half, because it's done on weekends. The cleaning system on the new line is efficient enough to let draining and cleaning go for 18 months so far.**
- **Total maintenance costs on the new system are under 10% of the costs for servicing the older system.**
- **Quality of the work is better because of closer control, better instrumentation, and more consistent operation.**

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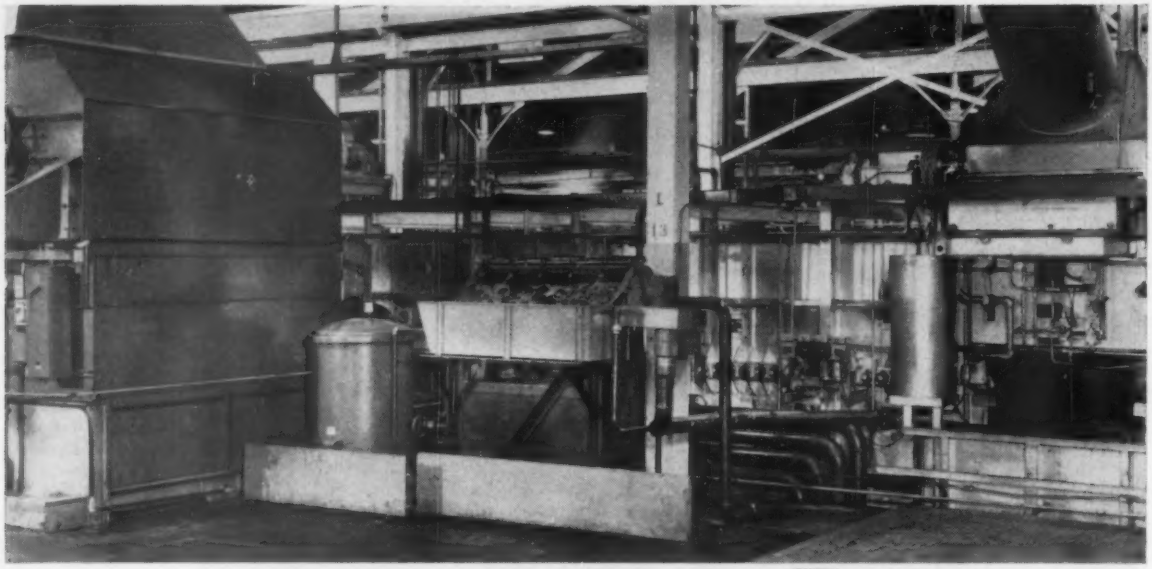
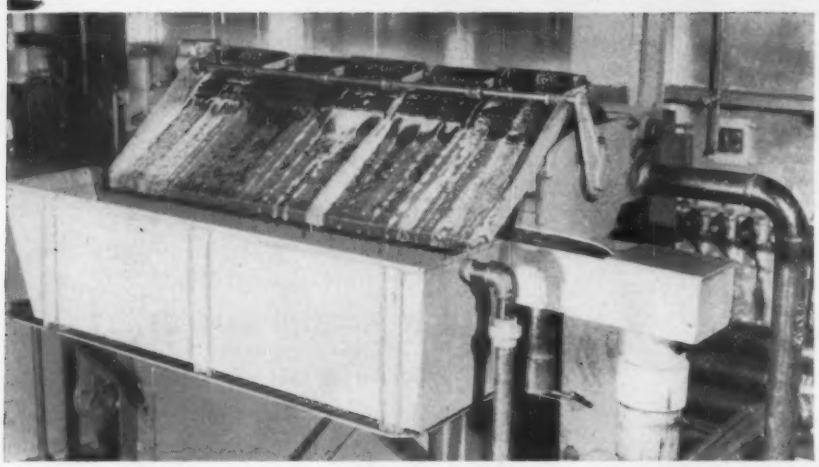
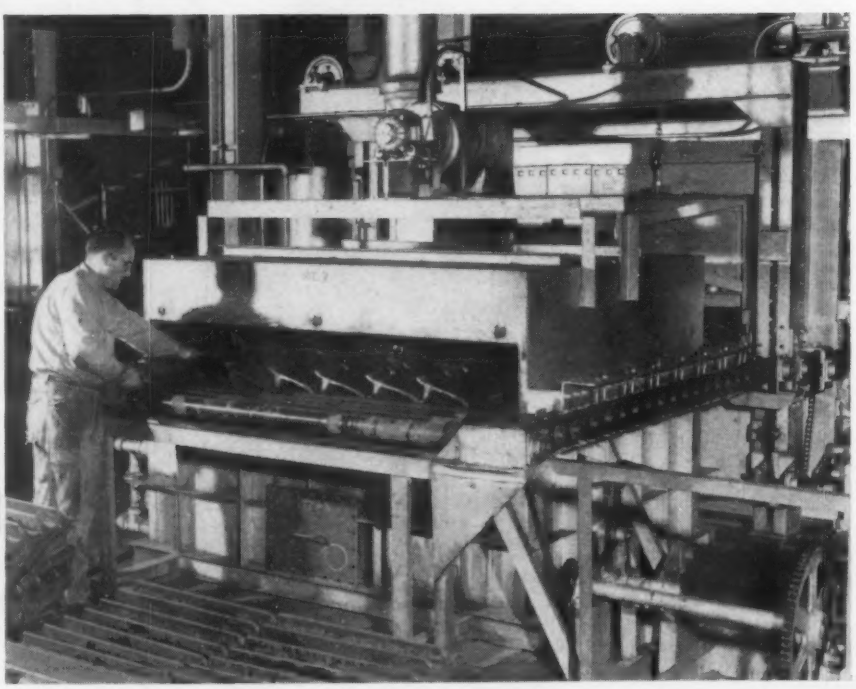
Oil quenching system . . . continued



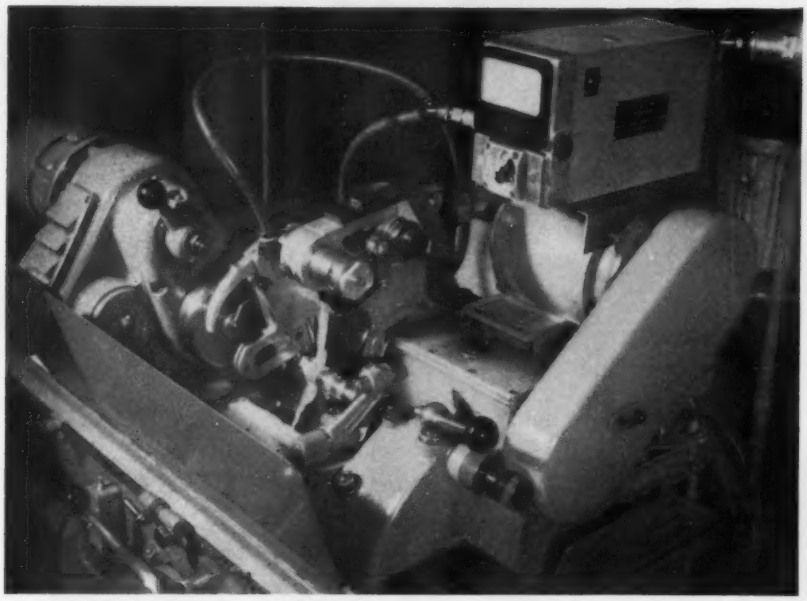
OIL FROM QUENCH TANK (right, rear) circulates through two Niagara evaporator coolers (left), which have capacity of 1 million Btu per hr. These were chosen over shell-and-tube heat exchangers because they use less water, require much less cleaning



BARNESDRIL SEPARATOR has five standard magnetic-separator drums mounted on a single shaft; length is 52 in. Oil goes through at 100 gpm, and separator removes about 6 cu ft of scale and sludge monthly on a 40-hr-week basis. Honan-Crane fuller's-earth filter nearby processes 20% of this oil



FINISHED SHOES EMERGE FROM DRAW FURNACE (right), through waterspray cooler (center) that drops shoe temperature to 125F, and are lifted off onto lift-truck platforms by bare-handed operator



PRECISION GRINDING of instrument parts on a production basis was greatly improved by the addition of this automatic size-control device. Taper, once a serious problem, is corrected by adjusting the machine table, then using control to hold final size

Electronic Autosizing...

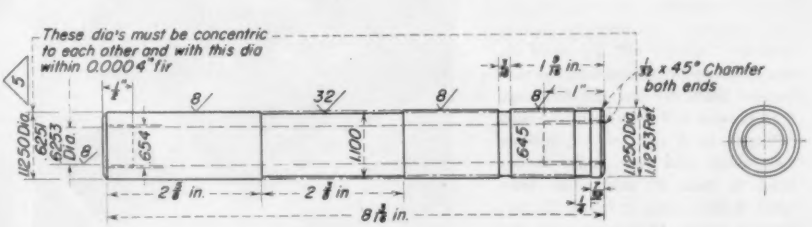
new principle improves grinder efficiency

Manufacture of precision instruments requires that dimensions be held within very close limits. Meanwhile, competitive prices and profits require quality and production—with a minimum of rejects. One example of the problems in precision manufacturing which face North American Philips Company, Mt Vernon, NY, is the SAE 660 bronze sleeve bearing used in the goniometer. At first glance it appears simple—until you see that over an 8 3/16-in. length, total allowed runout is 0.0004 in. and that the end diameters allow only 0.0003 in. to play with. Taper adjustment on the machine is critical!

After trying a variety of other systems and devices with only partial success, engineers decided to test the Electro-Autosizing machine control, made by Industrial Gauges Corp, Englewood, NJ. This device utilizes a principle of electronics, new to autosizing, known as variable capacitance (similar to the tuning condenser in your radio) in a comparator head which is preset to a master or to gage blocks. It is said to have a repeat accuracy within 0.000020 in. At NAP, tolerances on production runs are regularly held within 0.000040 in. and the problem of taper is no longer serious.

Operation of the device is simple: As shown, power unit and indicator are mounted on the machine in plain sight of the operator and the gaging head is mounted on the wheel head or adjacent to it; is free to swing clear of the work for loading or unloading. A switch controls "fine" and "rough" grinding sensitivity and the single knob is used to set final size positioning only. Each division under the knob represents an increment of 0.000080 in., more or less (plus or minus), stock removal. Each division on the indicator may represent 0.000040 in. or 0.0004 in.

This unit is intended for manually operated machines or for toolroom work and simply retracts the head when final size is reached. Another model is available for automatic control which has two setting knobs. One sets the exact oversize point at which slow feed or sparkout begins, the other determines the final size at which the wheel automatically withdraws. A supersensitive bench inspection gage can be coupled into the grinding-machine control for extra-close quality control of long production runs. For further details on automatic sizing see *AM*—Dec 1, '49, p 93.



INSTRUMENT SPINDLE is typical of dimensional accuracy that must be held

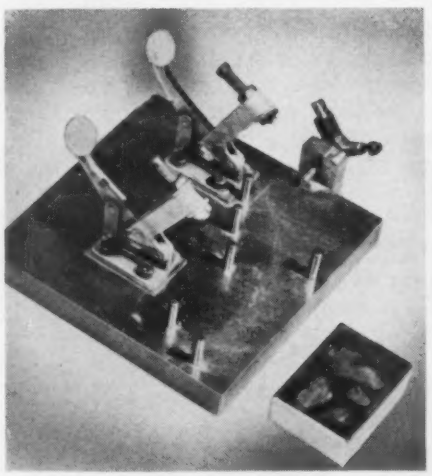
Tricky fixtures for abrasive-belt grinding

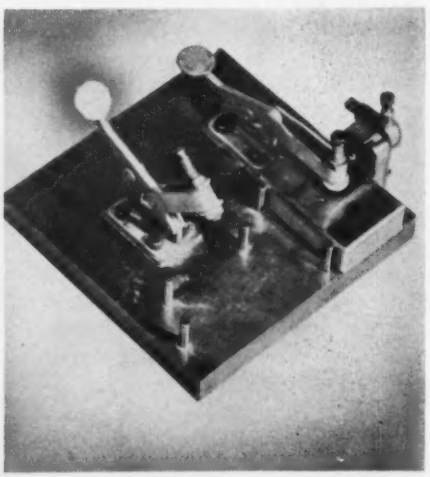
J J DURNAN
Behr-Manning, Troy, N Y

VERTICAL GRINDER WITH PLATEN has 8-in.-wide belt that's 107 in. long. Belts are changed when different grit sizes are required. Parts are ground in small lots, running from 25 to 1000 pc per year each, so setup changes must be fast

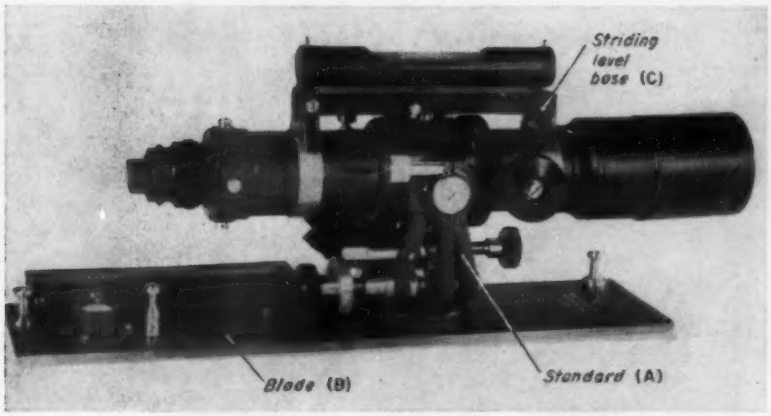
COOLANT IS SUPPLIED by drilled crosspipe on flexible hose. Normal accuracy for finishing is ±0.002 in., and if special jobs come through, this can be tightened to ±0.0005 in. Micrometer table stop limits feed, which is controlled hydraulically

They save 50 to 80% on setup time and 66 to 90% on production time at W & L E Gurley, Troy, N Y, by tooling up for abrasive-belt grinding which replaces milling and turning. The parts are for surveying instruments, small lots and high accuracy, and the fixtures are simple, but smart

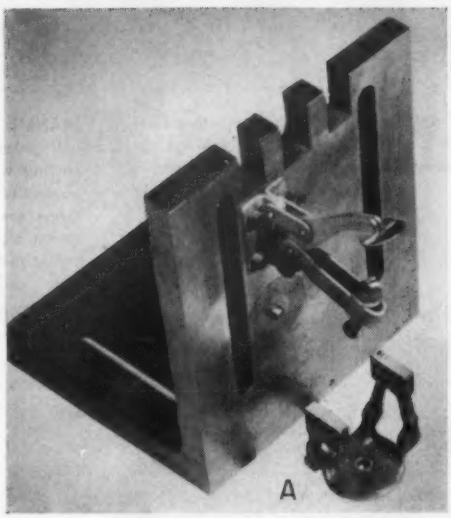


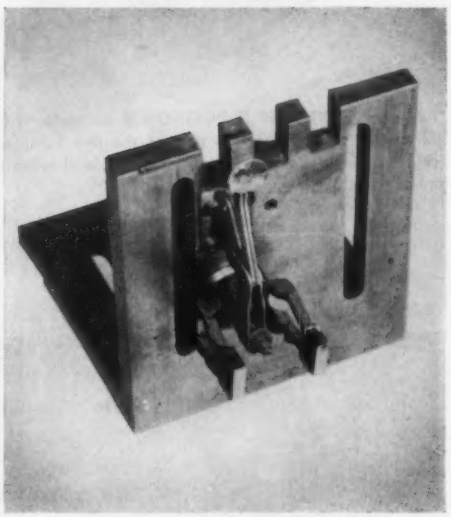


STANDARD CUBE WEIGHTS for a Gurley instrument are made of special no-seam, no-porosity brass, and are "dusted off" by hand on top and bottom to clean up the surfaces. They are cut off by saw, then ground with two belts, 60- and 180-grit, in 4 min, which finishes two sides and two ends. Setup used to take 60 min when they were milled; now it takes 30 min (saving 50%). Machining with the belt saves 66% in time

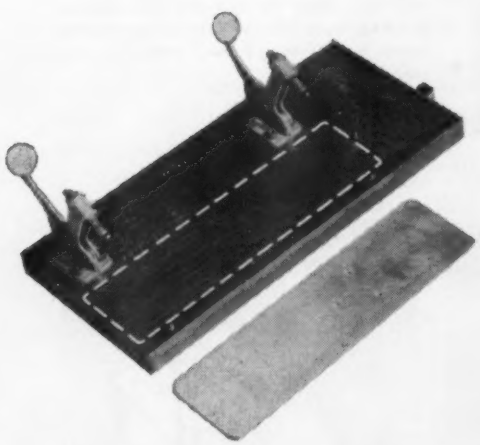


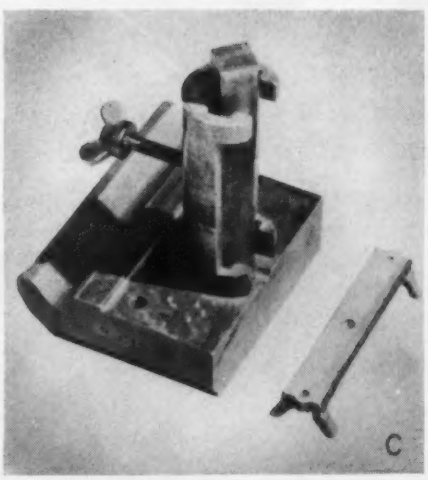
THREE ALIDADE PARTS now ground on abrasive belt are (1) blade—the long flat baseplate, (2) standard—the main double-arm yoke in center, and (3) striding level base—the long yoke just under the level tube

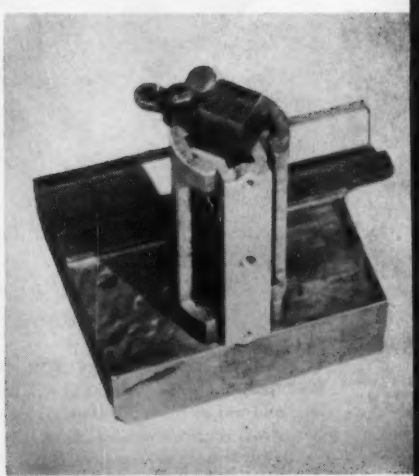




ALIDADE STANDARD IS FRAGILE, but fits over pin on angleplate fixture and is clamped by Lapeer lock. Setup time for grinder is 15 min; machining time with 80-grit belt is 1 min. Old milling setup was made in 75 min (saving of 80%), and cutting took 10 min (saving of 90%)





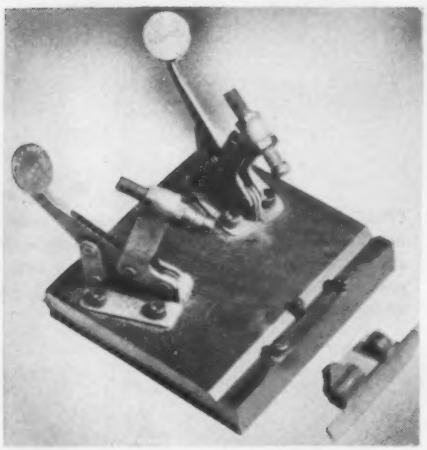


ALIDADE BLADES ARE GROUND on both ends at setup made in 30 min (saving 66% over old milling method). Machining time is now 2 min for two blades (saving 75% on older method). Two are done at a time, fitted against pin stops and clamped. After one end is ground, blades are reversed, pin is reset, and second end is ground. Metal removal is over 1/16 in.

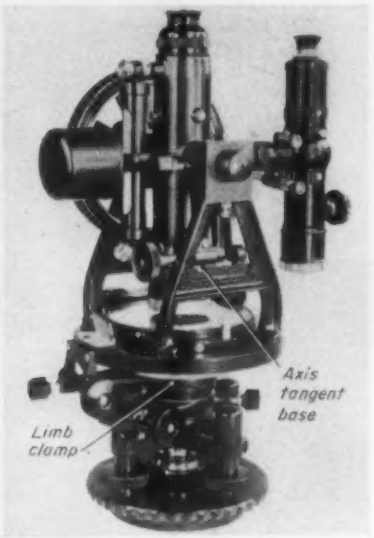
STRIDING LEVEL BASE IS GROUND, saving 75% on setup time and 80% on machining time. Yokes on part fit against square bar and clamp tube grips them. Setup takes 15 min; machining 1 min

PLEASE TURN PAGE

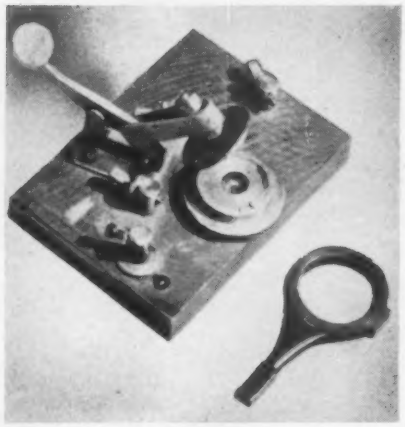
Tricky fixtures for abrasive-belt grinding . . . continued



AXIS-TANGENT BASE IS POSITIONED on plate with V-notch and two height-adjusting screws. Two lever clamps hold the part so the thin front edge is ground tangent to the hinge circle. Belt grinding takes 20 sec (saving 89%), and setup time is only 15 min (saving 75% over end-milling setup)

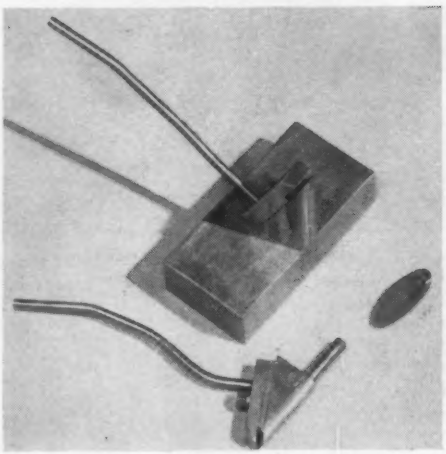


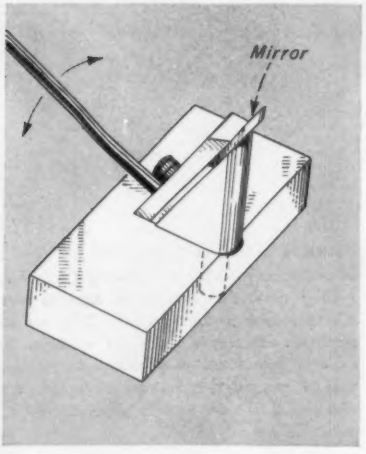
TRANSIT HAS TWO PARTS being abrasive-belt ground now: (1) limb clamp—a round casting with an arm, and (2) axis-tangent base—the fitting in which the adjusting screw (center) rides. Fixture for the limb clamp also serves for other parts, all with bosses to be surfaced



LIMB CLAMP IS LOCATED over a large pin with its arm against a side stop. Old system was slab-milling five at a time, but abrasive grinding takes only 12 sec (saving 87½%). Setup time is also faster, taking 15 min (saving 75%)

BOROSCOPE MIRRORS ARE FOR INSPECTING the inside surfaces of gun barrels, and are of a special stainless steel. Bar stock is power-sawed at a slant, which produces the required angle on one edge of each mirror, but the other edge had to be turned on a lathe to finish it. Now, this finishing is done with abrasive belt. Setup takes 15 min (saving 50%), and machining takes 4 min (saving 80%). Grinding is done in two stages, with 40- and 180-grit belts. Stock is clamped by setscrew in fixture, and handle is used to rotate mirror's edge against belt





Round Table

"Don't Promote Me"

"What can I do with a guy who's good but won't admit it, Ed?"

"I'll bet you're talking about Joe Adams, Al. He's quite a problem, but my advice is to let him alone."

"If he'd assume some responsibility, I could make him a group leader or setup man, Ed; but I think he's afraid he'll make a mistake."

"I'm sure he is, Al. He doesn't have any confidence in himself."

"What do you think would happen if I just promoted him without asking him if he'd like it or not?"

"You'd probably run into trouble, Al. Better leave him alone; he works hard, and he's no headache at all."

"Yeah, but if I don't use him, I'll have to promote Jenkins or Clark, and neither one of them is much good. Either of them will get a swelled head, probably, and start pushing the boys around."

"Then demote him later, Al."

"I hate to start something like that when I have a good man that knows the ropes like Adams does. I've tried to talk him into applying for the spot, but he claims he's happy where he is. Still, I know he can handle the job, and he can use the extra money, too."

"Look, Al; if he really wanted a promotion, he'd have been pushing for one years ago. He just wants to stay in his quiet corner and feel safe. He's probably scared stiff of responsibility. Leave him alone."

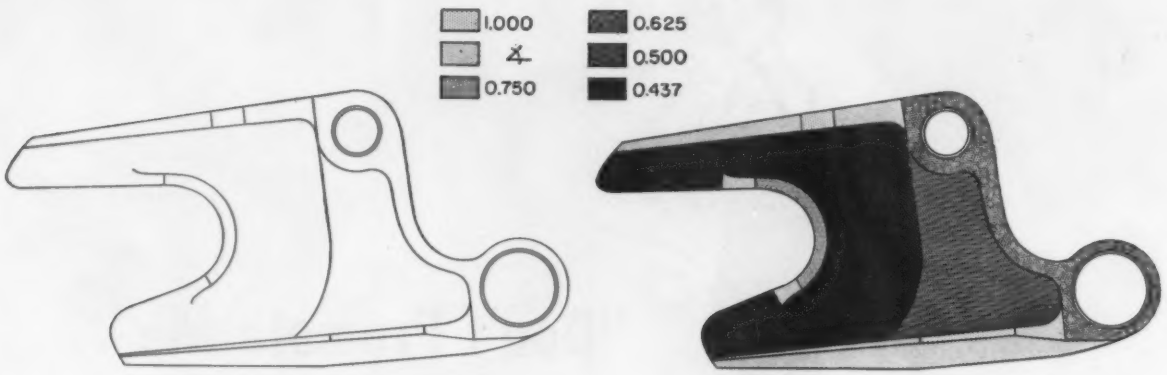
"But it's so wasteful, Ed. I know he's worth a better job, and so does everyone else. All he has to do is hint that he'd take it, and he'd be on easy street."

"It might be a lot tougher on him than you think, Al. He'd have to revise all his thinking; and I believe that's something he's not willing to do—think."

"It burns me up, Ed; seeing a good man go to waste when we have to push up half-baked knotheads instead."

***THIS IS** a real problem. Should Al try promoting a man who's afraid to advance, or should he try to "make do" with what other men he has available? And how safe is Adams, anyway, if he refuses to get out of the corner? Your ideas may help solve similar problems. Discussions of earlier topics start* *on page 180.*

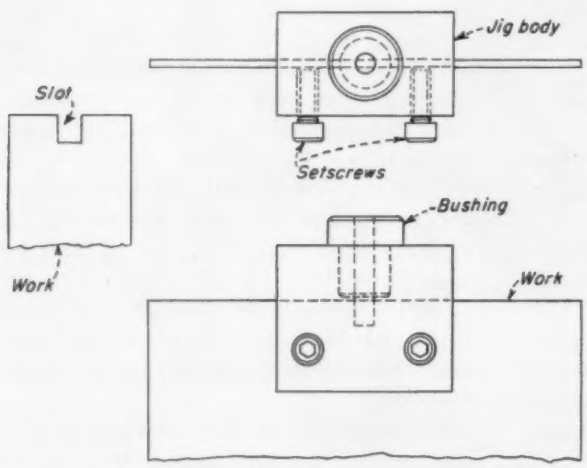
Practical Ideas . . .



Colored "Layers" Make Easier Blueprints

When making prototype pieces from solid stock, we find it is easier to color the blueprint. This gives the print a sort of 3-dimensional effect, and operators will have to spend less time studying the prints.

Colors usually start with the lightest color at the top and work toward darker colors for the deepest sections. One color is reserved to indicate tapered areas. *George Glaeser, Hicksville, NY*



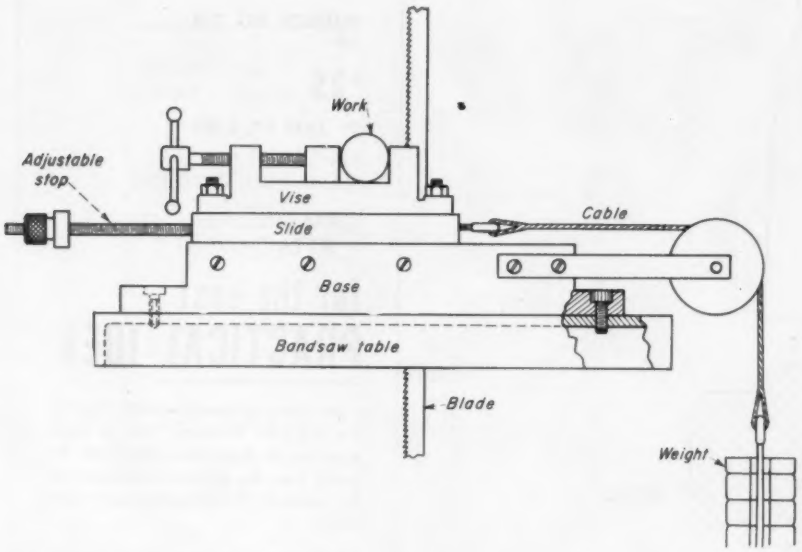
Clamp And Bushings Avoid Electronic-Part Disassembly

When we were manufacturing electronic assemblies, we got a design revision while in the midst of assembling the parts. The change required cutting a rectangular slot out of the edge of the panel.

The cut would ordinarily have been made on a milling machine or simply stamped out, but the units were already assembled, so we had to find a method to make the slot without disassembly.

What we did instead was to use the method shown here. We made a drill jig from a block of CRS. A slot was milled into the side of the jig just wide enough to slip over the edge of the panel, and deep enough to allow two setscrews enough room to grip the work firmly. Then, working from the opposite end of the block, we made a hole on the same centerline as the slot, just deep enough to break into the slot. This hole receives a drill bushing (press-fit if the jig is to be used for only one job). Two tapped holes on the side of the block are for the holding screws which secure the jig to the edge of the work.

In use, the block is slipped over the panel, locating to a scribed line which is laid out so the edge of the jig will be in the right location. The clamp screws are tightened, and a flat-bottomed drill is fitted with a collar-stop, to provide proper depth. The drill is chucked in a hand drill and fed slowly into the panel. The radius on the sides of the slot (caused by the diameter of the drill) was not objectionable for our purposes, but could easily have been filed off by hand if that had been necessary. *Albert I Levitt, Bronx, NY*



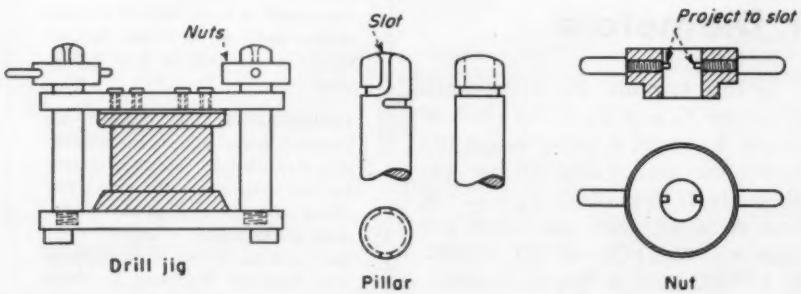
Cutoff Attachment for Bandsaw Raises Machine Versatility

Small shops which need a cutoff hacksaw will find this simple attachment to the contour bandsaw will serve the purpose well. The device consists of a simple dovetail slide on which a drillpress vise is mounted. The slide should be fastened to the saw table with either recessed-head socket screws or thumbscrews, for easy removal. Two dowel pins hold the slide in position, once it has been squared up with blade. The vise should also be squared up with the travel of the slide and locked in place.

A bracket built onto the base holds a small grooved pulley which supports a light steel cable which connects the movable slide to a set of weights to control feed of material. Rate of feed is varied by adding or removing weights.

A simple adjustable screw stop on the front of the slide can be adjusted to stop slide movement when the stock has been sawed through. *H J Gerber, Stillwater, Okla*

When a print called for 96 holes equally spaced on 0.0785-in. centers, we ran off an adding machine tape and gave it to the machinist with the print. Result: a saving of 20 minutes or more of the operator's time, with no errors. *Robert Roedder, Wayne, Penna*

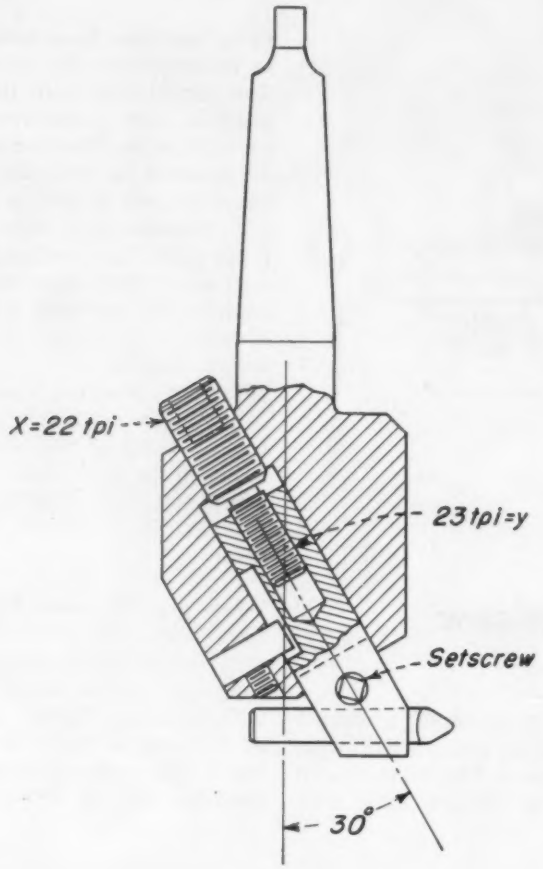


Bayonet Locks on Drill Jig Speed Loading of Work

To speed up loading and unloading of parts into a drill jig, we used the bayonet-lock nuts shown here. A short portion of two-lead thread was turned on the protruding part of the locating pillars, with each thread being cut for only half a turn. Then a keyway of the same width and depth as the thread was milled from the top of the pillars, connecting with each of the threads.

The nuts were bored 0.002 to 0.003 in. larger than the pillars, to give a smooth running fit. The turning bars are threaded and fit into tapped holes in the periphery of the nuts. A shoulder on the bars keeps them located so that about one turn of thread protrudes into the channel in the pillars, to engage the bayonet slot.

In use, the nuts are slipped onto the pillars, after the work is in place, and a quick pressure and twist on the nuts locks the work in place securely, even though it takes only half a turn to lock the nut. *W I Morgan, Somerset, England*



Differential-Pitch Boring Tool Easily Adjustable For Diameters

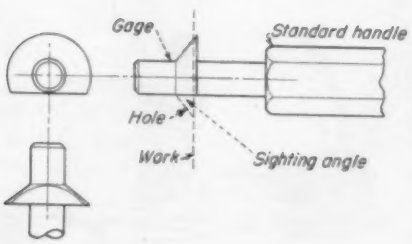
The boring tool shown here is easily made, but is still quite accurately and simply set. The differential-pitch principle sets the amount offset obtained with each turn of the adjusting screw.

To compute the amount of diameter-change, this formula is used:

$$(P_1 - P_2) \sin A = \text{Offset}$$

In this formula, P_1 is the pitch of screw X, and P_2 is the pitch of screw Y, while A is the angle between the axis of the tool bar and the body. If P_1 is 22 tpi, P_2 is 23 tpi, and A is 30, then the offset per turn will be (1/22—1/23) x 0.500, or 0.00099 in. *G R Milner, Lincolnshire, England*

Check Countersink Angle



Most countersink gages provide only for gaging the depth of the countersunk hole. The angle may also be checked with the same gage by putting a flat on the gage, as shown. Then the inspector can sight down the flat and easily check the angle, by checking the gap (if there is one) between the sides of the work and sides of the gage. *F C Elmo, Dayton, Ohio*

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JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

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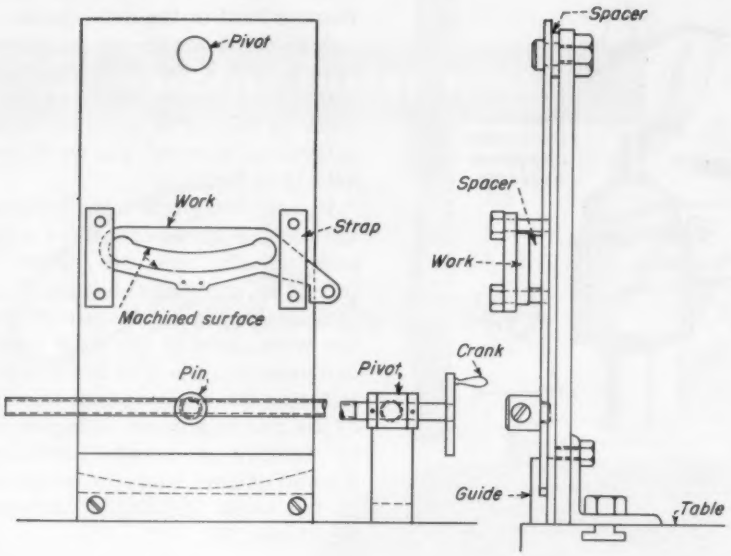


Pivoted Plate Holds Work For Milling Long Curved Slot

The pivoted plate shown here overcomes the trouble we were having when milling the curved slot in scale-model valve gears. We didn't have a large enough rotary table, so we built this device.

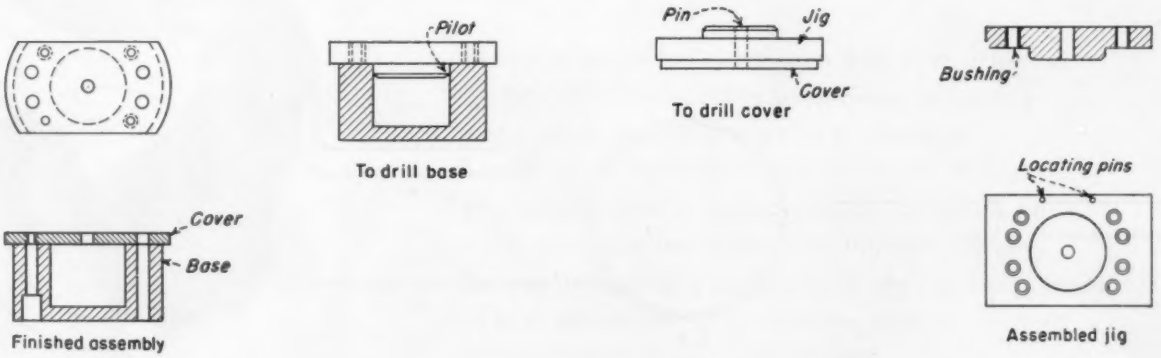
The work is strapped onto the plate, with a spacer to provide for tool clearance. Near the bottom of the plate is a tapped hole for the threaded shank of the tapped pin in which the leadscrew runs.

This pin pivots on the threads in the plate, and must be located high enough so the far end of the screw will not hit the machine table at the end of the stroke.

Spacer and guide straddle the lower end of the plate, providing a snug running fit on the plate. The crank feeds work into the cutter.

The fixture could be used in either a lathe or milling machine, but lathe use would require a tie-plate between the rigid vertical plate and the bracket supporting the leadscrew. Also, if the fixture is used in a lathe, it should be placed on its side, because of the fixed location of the lathe spindle.

This design can be modified and made more useful by milling teeth on the bottom of the work-holding plate, and replacing the leadscrew with a worm. Then one turn of the worm will move the work through one degree of arc, regardless of the distance between work and pivot point. *Laurence H Austin, Butler, Penna*

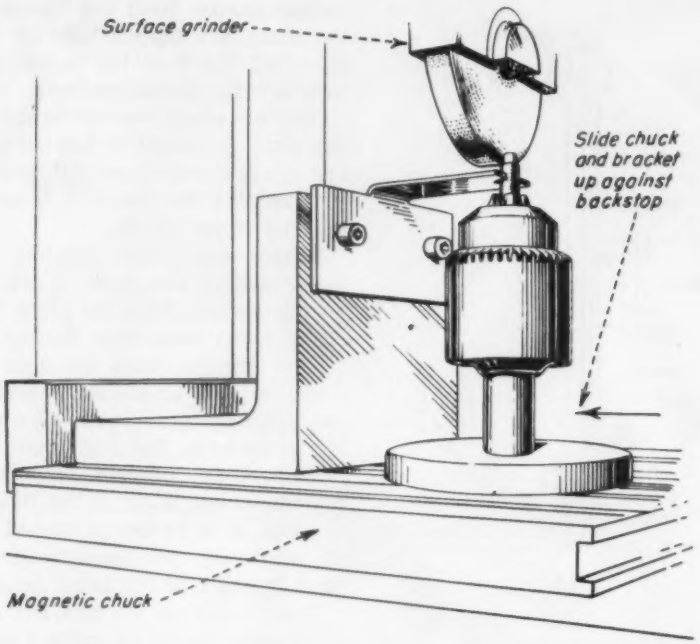


Inexpensive Drill Jig For Mating Parts

To drill holes in mating parts, it is often easier to use a common bushing plate for both parts, so the holes will match accurately. With this method, the expense of making precision jigs can be avoided when the cost would be prohibitive.

We had a case of this kind, where we needed 20 matching covers and bases for a plastic part which had eight holes to be drilled in cover and base. The bushing plate had a pilot which was used to locate the plate in the base. To do the top, the plate was inverted, and a locating pin entered a hole in the part.

When the holes were drilled, they matched perfectly, having been located from the same points in the drill jig. *George Herzl, Camden, NJ*



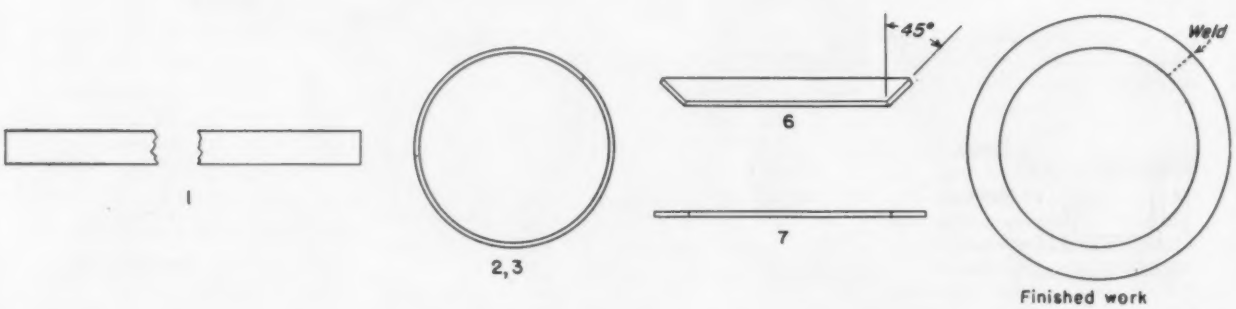
Surface Grinder and Attachment For Grinding Small Punches

The attachment shown is very useful for emergency repair work when grinding the end of small round pieces. We occasionally use the method to grind a smooth part onto the end of a file, or to reduce the diameter of a punch, if experimental parts show the diameter is a little too large.

The parts are quite simple. A common drill chuck is mounted on the end of a stud, the other end of which is fastened into a flat plate. Work is held in the drill chuck.

A piece of angle iron is ground square, and a sheet metal arm is bolted onto the side of the angle. A notch in the end of the sheet metal is used to "receive" the work, and hold it in location.

In use, the angle iron is placed against the backstop of the magnetic chuck, and the power is turned on, gripping the angle. Then the chuck power is turned off, and the work, held in the drill chuck, is moved into the V of the bracket. Rotating the work against the side of the grinding wheel, it is possible to remove a small, controlled amount of stock from the periphery of the work. *Rudolph K Schmitt, St Albans, NY*



Seven Steps Save Stock When Forming Collar

Making a large reinforcement collar without waste of material was done easily with the sequence shown here. The steps are: 1) Shear to developed length. 2) Form band. 3) Butt-weld. 4) Remove flash. 5) Anneal the weld. 6) Form to 45° angle. 7) Flatten.

The last step (flatten) is overdone, to allow for springback. All forming operations were done cold, on 5/32 x 2.50-in. hot rolled and annealed 18-25 carbon steel strip.

With this method, we were able to avoid cutting the collars from flat stock, wasting all the excess material around the actual work. *G F Oliver, Warren, NY*

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FUNCTIONAL COLOR...I

Extracted from a talk by Faber Birren, industrial color consultant, at the World Conference on the Prevention of Industrial Accidents, Rome, Italy, April 2-6, 1955.

Seven well-established causes of eye fatigue, which is one important reason for accidents, are:

1. Glare
2. Excessive contrast
3. Distressing brightness
4. Prolonged focus on close objects
5. Constant adjustments from light to dark fields
6. Repeated adjustments in focus from near to far
7. Lack of relaxing field on which focus can rest from time to time.

In turn, these causes of muscular eye strain result in several disturbing effects:

1. Severe dilation of the pupil during coarse work
2. Higher rate of blinking
3. Reduced sensitivity of nerves at the edges of retina
4. Nervousness and emotional irritability
5. Nausea

LIGHTING LEVELS

Strange as it sounds, light from a so-called "daylight" source is not always as good as yellowish light, because highest visibility is in the yellowish region of the spectrum. Blueish and reddish light sources are not desirable for best efficiency.

Lighting levels have gone up steadily in recent years, yet a level of 35 to 50 footcandles is optimum. This is because it may take a level of 100, 500, or even 1000 footcandles to boost visual acuity greatly over that at 35-50 footcandles. It is more efficient to keep the general shop level at 35-50 fc, and add local lighting where necessary, especially if a single light source helps in the task by throwing shadows that give the work dimension.

Best acuity is reached when the work, or foreground, is just a bit brighter than the background, or walls. Brightness ratios in the field of view should not exceed 10:1, and 5:1 is ideal. Continued opening and closing of the pupil as focusing changes is quite tiring.

EYE REACTIONS

The human eye adapts quickly to brightness, but slowly to darkness; so if the work, say a machine, is quite dark in respect to the shop walls, a worker must wait some time after looking up from his job before he can get back to work. Colors help in this because a soft wall color and bright light on the job will help relax the worker when he looks up, yet help him concentrate quickly when he goes back to the task. Brightness is generally conducive to physical activity, while softness of color is conducive to mental activity.

BEST COLOR PRACTICE

Ceilings and overhead installations should be white, with a reflection of 75% or higher. Color overhead tends to divert interest and reduce light.

Upper walls in shops where work is manual should reflect 60% or more of the light that hits them. Good colors are yellow, ivory, and pale green. Walls where the work is more mental should have slightly less reflectance—50 to 60%. Preferred colors are soft gray, green, tan, and coral.

Dados, trim, and floors should have low reflectance values—25-35%—and colors should be darker shades of wall colors to reduce color contrast.

Machinery should also reflect 25-35%, and best colors are gray and green. Bright colors should not be used except where they have a safety function; even moving heads, beds, and tables to which the worker's attention should be directed should be a not-too-bright color, such as buff, assuming they have guards or are not too accessible.

Backgrounds to which workers may look for relaxation, such as end walls, machine shields, and the like are best with a low reflectance value—such as 20-30%, and colors should be subdued and soft; perhaps green, blue, or terra cotta. The same goes for bench backs.

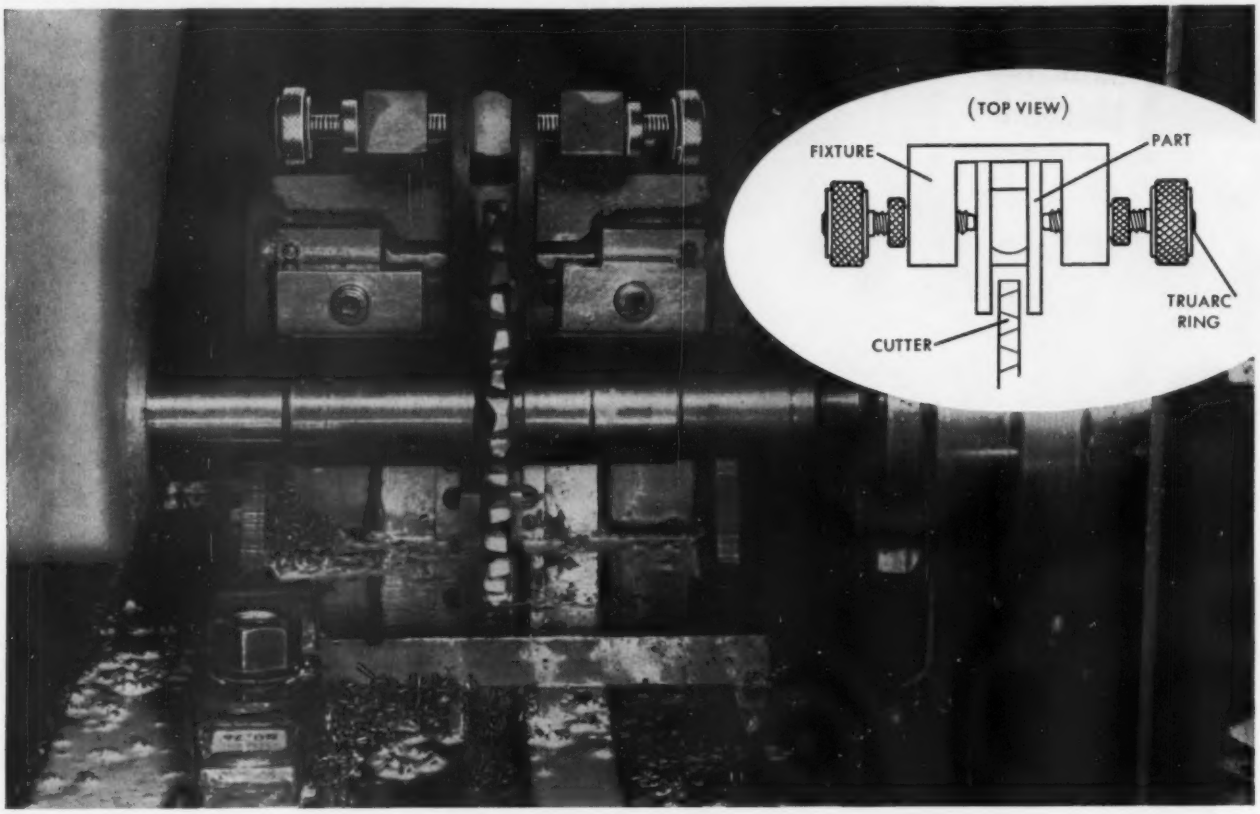
COLOR STANDARDS

Functional colors on walls and machines can do a lot toward helping workers; both in keeping them busy and in helping them rest. The cooler colors, such as blue, green, and shades between, are passive, and they help relaxation. They also counter high indoor temperatures.

Gray is neutral, and useful where work is close and any color distraction would hinder the workers. Gray is also helpful when added in small quantities to brighter colors, but not to safety colors, because it tones down vividness to prevent distraction, and helps colors last longer because they don't show soiling so easily.

Warm colors, such as yellow, have a poor effect on walls and machines, but their luminous qualities are valuable on stairways and in corridors. Where there is a total lack of daylight, and where a warm effect is desired, hues of buff, peach, or coral are often pleasant.

White is best for storage areas because it reflects



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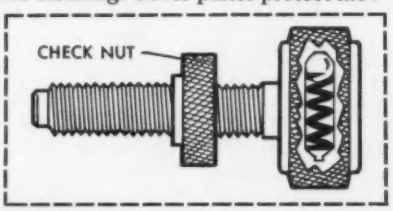

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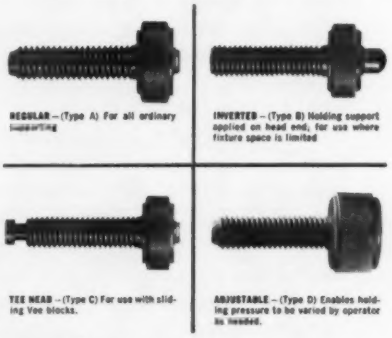
REGULAR – (Type A) For all ordinary
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FUNCTIONAL COLOR...II

more light and lets the colors in work areas be emphasized.

HOW MANY COLORS?

Answer: As few as possible. For example, the U S Navy, with installations of all kinds, including industrial, repair, training, and all, uses only 22 colors all told:

Walls and trim—3 greens, yellow, tan, ivory, peach, gray, terra cotta, and light blue.

Outside walls—white, suntan, and dark green.

Equipment—3 gray shades and buff.

Safety color code—fire red, brilliant yellow, vivid orange, bright green, and clear blue.

The average plant can probably use far fewer colors, which keeps maintenance costs down and simplifies paint buying.

IS COLOR WORTH ANYTHING?

The answer is a definite "yes." When 350 companies were surveyed by the National Industrial Conference Board of New York, many of them answered that they couldn't evaluate color programs properly because the effect is largely intangible. Yet:

64.7% said color had improved lighting
27.9% reported increased production
30.9% noted improved work quality
19.1% noticed reduced eyestrain and fatigue
14.7% credited color for reducing absenteeism
75% were satisfied with their color programs
5.9% were not satisfied
19.1% had no opinion

Another test made by a government accounting department over a two-year period came up with an average 5½% increase in efficiency—and one job improved 37.4%. The results were partly produced by added lighting and partly by better color in the office.

SAFETY CODE

Although safety colors are not universal, nor are they standard in all industries, there is general acceptance of the main points of safety color coding. Here are some of the most important uses of functional color for safety:

Yellow—by itself the most visible color, even in poor light, and striped with black it shows the highest contrast possible. Used for hazards, such as switch-engine bumpers, pit and platform edges, crane beams, floor risers, railings, and the like. U S Navy puts yellow on flammable-liquid containers, which are identified in black letters, and on signs and guards.

Orange—highly visible and a good attention-getter, used on hazards that could cut, crush, burn, or shock workers. Industrially, orange is widely used on moving parts of machines, like cutter heads, levers, on electrical equipment, hot pipes, and control handles. U S Navy practice is to put orange on emergency controls—mainly cutoff switches and buttons—and to use blue for regular control boxes. Navy studies show that red and red-orange colors are most detectable of all (in direct conflict with general industrial opinion) and air and sea rescue codes have been revised accordingly.

Red—exclusively for fire protection, on fire-alarm boxes, extinguishers, apparatus, and hydrants.

Green—the symbol for first aid, is for medical equipment, gas-mask cabinets, and signs for dispensaries.

Blue—as a precaution, it marks electrical control panels, temporary obstructions, and anything that should not be operated or moved without authority.

Purple—a new code color indicating radiation, put on containers for hazardous materials and on signs marking danger areas.

Black, white, and **gray**—used generally to keep order, as on aisle lines or markers, storage areas, behind waste receptacles and other housekeeping aids.

In most cases above, the code color not only marks the equipment or part in question itself, but is applied to a larger area—for example, a big block of red paint behind and above a fire extinguisher to call attention to it and to make sure it can be located from some distance away.

There are also many specialized color codes used in small industrial circles, such as for compressed gasses, warning and danger signs, and Navy and Coast Guard hard hats.

IS FUNCTIONAL COLOR EFFECTIVE?

Even though it is often difficult to trace directly from cause to effect when considering something as intangible as the value of functional color, there are many cases that give a definite "yes" answer.

For example, the New York City Board of Transportation cut accidents among 38,000 workers by 42.3% with an active safety program, an important part of which was color coding.

The U S Navy also cut accidents—by 28%—in three years with a safety program based on color.

There are many other cases, most of which also involve better lighting, publicity and education programs, and other factors, in which accidents have been sharply reduced. Color is an integral part of many of these, and is a contributing force for more awareness of the worker to the risks he is taking, or more properly to the risks he can avoid because he has been warned in time—by color.

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American Machinist REFERENCE BOOK SHEET

10 QUESTIONS ABOUT JIGS AND FIXTURES

Cost of tooling in medium and small-sized plants is one of the largest expenditures, other than for labor. Such plants can seldom justify single-operation equipment: instead they must seek low-cost tooling to be applied to general-purpose machines. The process engineer's job is not done properly if he merely duplicates for new jobs the tooling designs that have produced suitable quality on similar jobs. No reduction in costs results from this practice. Only through putting more engineering into better jigs and fixtures can we reduce tooling costs.

GUIDE TO COST REDUCTION

Answers to 10 basic questions should be known by engineers and tool designers before new tooling is designed or selected:

1. Will the new tool pay for itself?

Only a dollars-and-cents analysis should be used to predict production savings. If new tooling, as compared to existing tooling, will pay for itself in one to five years the expenditure for new tooling can probably be justified.

2. What is a jig and what is a fixture?

There are various definitions. Mine are: A jig is a movable workholding device that must be moved to and from the working position by the operator; a fixture is a stationary workholding device fastened to the machine.

3. What are relative loading and unloading times?

Definite time values are used by some shops for operating jigs and fixtures equipped with screw clamps, quick-acting clamps, leaves, adjustable stops, slip bushings and other components. If such data are not available, at least pictorial charts of good designs, better and best will be helpful to designers.

4. What are the comparative costs of operating one jig or fixture vs. two?

Factual evidence does not justify the assumption that one device will get the job done cheaper. A specific job should be broken down into time elements and the choice of one vs. two jigs or fixtures then made from the total time values.

5. How much does it cost to load and unload a fixture or jig?

The answer, in part, is found from the above time study or estimate, depending upon whether similar tooling is in use or time values are known. The study may well point to unnecessary restraints upon loading and unloading.

6. Can tooling standards be put into effect?

Many large companies have found it profitable to standardize on standard tooling designs. Don't work up simplified or better designs for use on occasional jobs, try to apply such ideas to the bulk of your production. Soon there will emerge a set of more or less standardized designs that will save toolroom time and operator training time. You can improve your standard designs as time and occasion permit.

7. What standard, purchased components can be used?

Parts made in the toolroom are seldom competitive with standard manufactured parts. The latter also have the advantage of being a speciality upon which much research and improvement have been lavished. Why not use such items to reduce costs?

8. Is it necessary to make a tool drawing?

Many manufacturers still disregard the use of a tool-design section. Often they place tool orders directly with the toolroom and let this department strive to come up with a usuable tool. This is false economy. The manfacturer who uses a tool-design department gets ideas from his designers. He may get standardization with its economies. The tool or fixture drawing is a record that is useful for reorders or repairs without taking excessive toolmaking time. A better understanding is provided by the drawing when adaptation to another part is under consideration. Better control is obtained all along the line.

9. Does the designed tool meet check-list requirements?

We often forget or overlook details of good design unless a check list is at hand. Such a list should be provided to process engineers and tool designers, as a reminder when planning the job and executing the design.

10. Should tool designs be frozen?

Some one is bound to come up with a better idea after a tool is designed. Changes can't be allowed to get out of hand, if you are to get parts into production. However, if costs can be reduced further, production will not be unduly held up, and design changes will not make tool cost prohibitive, you should go ahead with the change.

RECOMMENDATIONS

The points advanced are known to many manufacturers, but it is surprising to see how many other firms disregard them. These recommendations, if not used now, may prove helpful:

1. Acquaint process engineers and tool designers with the best tooling methods cost-wise. Supply a booklet illustrating all of the holding methods used in your plant and other good ones too.

2. Plan a tool-revision campaign, based on yearly production requirements of the tools, to apply new ideas to old tools, in order to reduce labor costs.

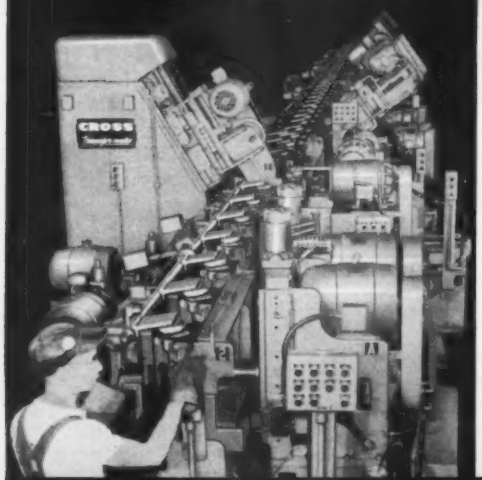
Abstracted from "Better Jigs and Fixtures at Less Cost," presented by M J Look, process engineer, Singer Mfg Co, Bridgeport, before ASME Management Division Conference, Cleveland, March 23-24, 1955

Warner Gear Reduces Downtime with Cross Machine Control Unit

A Mechanical Eye...

(U.S. Patent Nos. 2679038 and D-163935. Others Pending.)

At right, set-up man pre-sets tools at Warner Gear Division, Borg-Warner Corp. for Transfer-matic below.



"We are well satisfied with the results we have obtained from the Cross Machine Control Unit," says Emory Watson, Master Mechanic of Warner Gear Division of Borg-Warner Corporation.

Warner Gear's experience is typical of many users. Over 500 Cross Machine Control Units are successfully reducing costs of many metal cutting operations. Here's why:

Toolometers on the Machine Control Unit assure improved tool changing programs and maximum tool efficiency. Tools—pre-set with standard fixtures and gages to eliminate machine adjustments and trial cuts—are stored in the Machine Control Unit convenient and ready when needed. Results: Reduced tool costs . . . less downtime . . . higher operating efficiency.

You can get the same cost saving benefits as Warner Gear. Write, wire or phone The Cross Company for full information, today.

Established 1898

THE CROSS CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

Talking Shop . . .

Bargain Basement

CURRENT COST for jet engines is only $2.56 per hp, as compared with nearly $17 for piston engines for military planes—yet the jets produce more hp per pound. They develop as much as 4 hp per lb, as compared with 2/3 hp on WW II piston engines. Another cute statistic from "Planes," publication of the Aircraft Industries Assn: A plane that requires 11,000 hp to fly at 600 mph would require 67,000 hp to fly at 1000 mph. That's what speed does to power.

Toolmaker's Society

AMERICAN SOCIETY OF TOOL & DIE MAKERS, started from scratch just nine months ago by Harvey Jacobsen of Jacobsen Mfg Co, Kenilworth, NJ, now has nearly 1000 members from all over the US, plans to organize chapters in tool and die centers soon. The ASTDM is a technical society designed to disseminate information among the tool and diemakers themselves—from apprentice to master craftsman. It isn't concerned with labor or management problems.

Rail Bond Braze

US STEEL, Nelson Stud Welding, and AGA (Sweden) have combined to devise a method of silver brazing signal bonds onto railroad rails. A 5-in. flexible bronze cable is brazed across the rail joint in a few seconds, avoiding high temperatures which cause brittleness in the rail, as well as the necessity for chemical treatment or drilling holes. Braze current is 200 amp at 36 v and equipment is carried in a light-weight cart which can run on wheels. Special bonds are used incorporating flux. The initial arc releases the flux, then solder immediately after. When solder is fluid, current is cut off and the copper lug pushed down into the pool.

Hafnium Carbide

IN *AM* FOR MAR 28 (p 153) we mentioned hafnium carbide, and described it as the hardest material made by man. We now find further that it has a true metallic appearance —is not glassy like boron carbide— and the problems of thermal shock and alloying are not likely to be so great. Thus it may have broader cutting application than boron carbide, now used principally as an abrasive powder, in ultrasonic cutting, and as an ultra-hard gage material. BUT, hafnium is now about $15.50 a gram —a prohibitive cost, even to get samples for study. If zirconium, with which hafnium is usually found, becomes necessary in large quantities for government programs, then hafnium cost may go down. Hafnium, as we said some months ago, "likes" neutrons, while zirconium does not. Thus, to use zirconium in nuclear reactors, the hafnium must be removed from it.

Loose Talk Costs $$

WE'VE JUST HEARD the sad, true story of a large aircraft company that got in a bit of trouble because of a perfectly innocent remark. The president, on tour through the plant, noted that one stockroom was a mess. So he chided the vice president in charge of production, who lectured the material supervisor, who bawled out the stockroom foreman, who chewed out the stock boy. The matter had taken on a good deal of urgency by this time, and the stock boy was ordered to get that mess cleaned up, get every piece of material lined up with the front of the bins, and to do it by 3 o'clock or not come back.

Well to make a sad story short, the stock boy was a hard worker. He did it. And in doing it he cut a batch of wing spars in half, to make them fit neatly, and it cost $120,000.

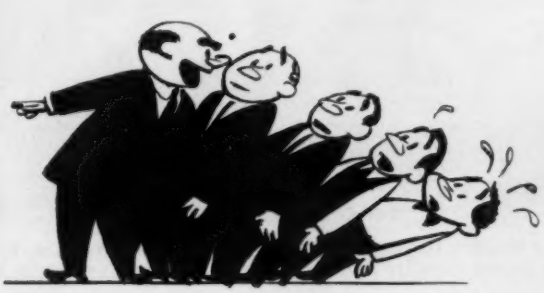
The story was told us by the production manager of an aircraft engine plant (no spar user, he). His point was that accurate communications is a problem and we should come, he said, to the discussion of the problem included in the production forum at the spring SAE Aeronautic meeting. As we can't go ourselves, we'll have to send someone —if we can communicate the instructions successfully.

What Happened to Wanamakers?

A WHILE AGO we published an announcement by a New York real-estate firm that the recently defunct John Wanamaker department store in New York's Greenwich Village would be converted into a permanent machine-tool exhibition building. Well, now it looks like the idea has fallen flat—practically no response at all from machine-tool builders—US or foreign. Now, Wanamaker's two buildings and warehouses will be turned into offices and showrooms for anybody in any line at $1.50 per sq ft per year. And machine-tool firms are still welcome—if any are interested.

Rain Erosion

CONVAIR is testing destructive effects on metals of transonic and supersonic speeds by a unique ballistics method. Test specimens are mounted in the nose of a modified 20-mm projectile and are fired horizontally through a sprinkling system 500 ft long. Nozzles are 10 ft apart along a pipe 3 ft above the ground, produce rainfall at 2 iph with average drop diameter of 2 mm. A fuze in the nose, ignited upon firing, sets off a black-powder separation charge after ¾ sec. This ejects the test specimen and a 6-in. parachute which stops the specimen within 10 ft, about 1500 ft from the firing point. Projectile speed can be varied from Mach 1 to 2.5 by controlling powder charge.

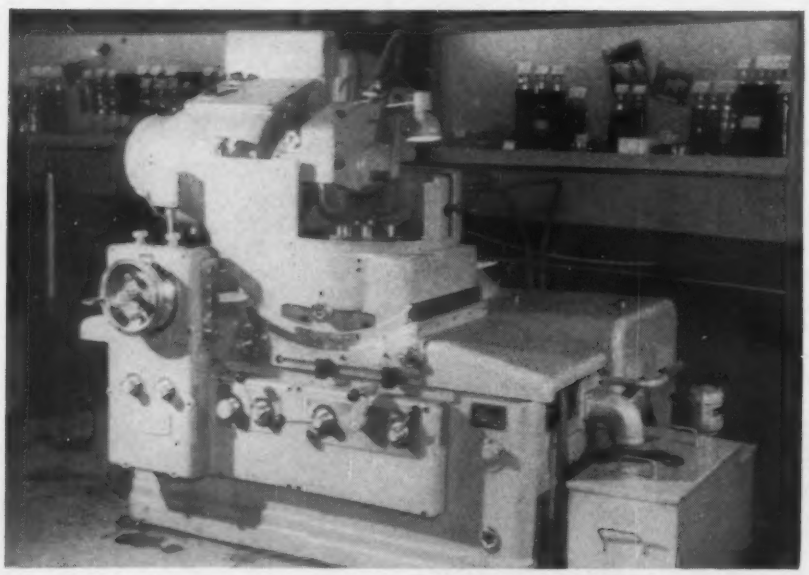


News of Metalworking . . .

Heroic-size statute of Mao Tse-tung dominates approach to Chinese machine tool section

LEIPZIG FAIR 1955: Machine Tools Get Top

In a plush setting of silks and gilded friezes, the Iron Curtain countries put on an impressive show of machine tools — including broaches, hones and other types never before shown



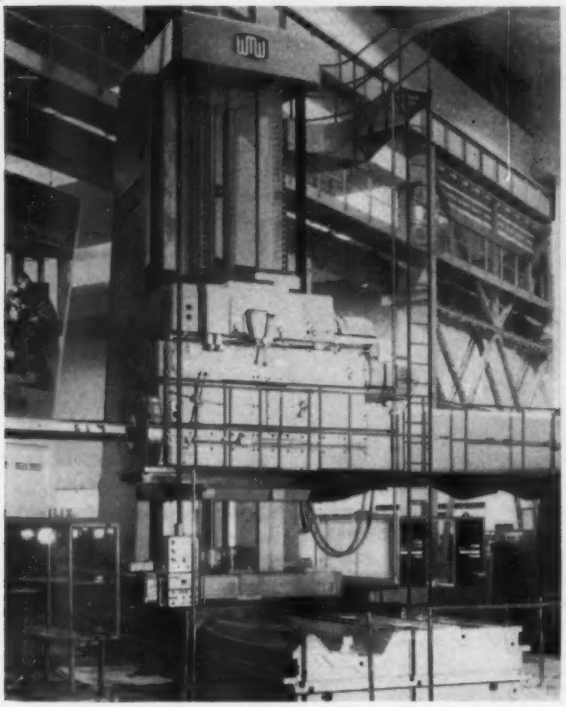
Soviet surface grinder features a tilting circular table. Grinding wheel is 15 in. in dia and is driven directly from motor. Table speeds are 40 to 210 rpm

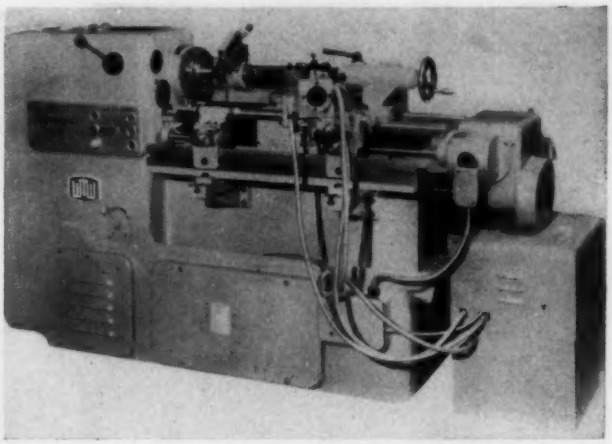
LEIPZIG, GERMANY — Machine tools again dominated the industrial and commercial exhibits at the Leipzig Fair, the Communist countries' showcase for export goods. Russia and her satellite exhibitors —Red China, Czechoslovakia, Poland and eastern Germany— are becoming increasingly serious in their bids for export markets. Even the more backward satellites are trying to get on the export machine tool bandwagon — simply because prowess in building machine tools is regarded as a yardstick of industrial development.

China Shows Progress

Red China is typical of the latter group, even though it is reported that China has delivered some machine tools in its trade agreements with Indonesia and China. The 20 or so machine tools exhibited in China's ornate pavillion suggested a further advance in tool building technology since the last Leipzig Fair. Among machine tools exhibited by China were a thread roller, a multi-tool lathe, and a pantograph copy-miller, plus the usual standard lathes, boring mills, etc.

As in the past, Chinese machines





East German production lathe has eight spindle speeds to 2800 rpm, 12½-in. swing over bed, 19 in. between centers. Can be equipped for hydro-copying with master in front (as shown), mechanical copying from templet with rear-mounted tool, simultaneous internal and external turning of rings, and internal contour turning

Largest and latest East German horizontal boring mill has 9 13/16-in. spindle with stepless speeds from 0.5 to 180 rpm. Zeiss optical equipment permits accurate control of spindle and boring head movements

Billing as Reds Bid for Bigger Export Markets

closely copied Russian ones, and the type number of their Soviet counterparts was clearly indicated on the data card. Lone exception to this was a materials testing machine said to have been designed by the Chinese Scientific Institute. One Chinese engineer indicated that there'll be more original designs out of China in the next two years or so.

The Polish exhibit, where a large collection of machines was displayed, bore a more business-like appearance. Five to six months' delivery time was freely quoted for Poland's first single-spindle automatic, which was in the prototype stage only 18 months ago. The designer was on the spot to explain the features of this 7-mm machine, for which he claimed eight patents, including: the pairing of steel change gears with ones made from bakelite-impregnated silk to reduce noise; a powder-filled barstock carrier for further silence (stock is wiped by felt pads before entering the chuck); quick removal of the chucking head for cleaning; the ducting of cutting oil inside the tool frames; micrometer adjustment on each tool holder; and spring-loaded split gear on cam-shaft drive.

The finish of this machine was very high by past Polish standards, and the inventor explained that this was of great psychological value, for it stimulated the operator to turn out better work. In fact, he said, he had been complimented on this by visiting Swiss manufacturers.

Among other Polish machines at Leipzig were spline, internal and roll grinders; vertical boring mills, and an unusually rigid plano miller. A full range of machine tools from current production was promised for Poland's own Poznan Fair to be held in July.

Czechs Eye Export Market

Emphasis at the Czechoslovakia hall was on export throughout. Large and complicated types were featured, such as the FK 08 copy miller and die sinker, which was exhibited in two versions. The latest Skoda (now Lenin Works) lathe was on show. This 15-ton machine with 1,250 mm. swing and 5-metre turning length provides for screw-cutting controlled by a rack and pinion and for taper-turning.

One Czech engineer said that because of the number of inquiries from so-called "underdeveloped" countries in South America and the Middle East, next year's display will include a fuller selection of simpler machine types.

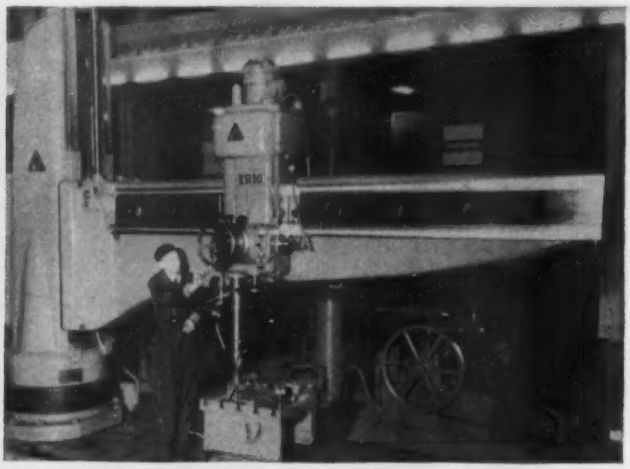
Russia Shows New Types

The Soviet Union's display of machine tools was impressive, set against a lush backdrop of draped silks and gilded friezes, plus a background of Balalaika music alternating, with, believe it or not, the hot trumpet of Harry James. Russia showed several types of tools not previously seen at Leipzig, including vertical and horizontal broaches, a jig borer, a surface grinder with tilting table, and a large vertical hone.

The broaches, it was stated, were products of a new factory recently completed at Minsk. All the Russian machines showed considerably greater attention to external finish. Unpainted surfaces, for instance, were finely ground and hand-scraped.

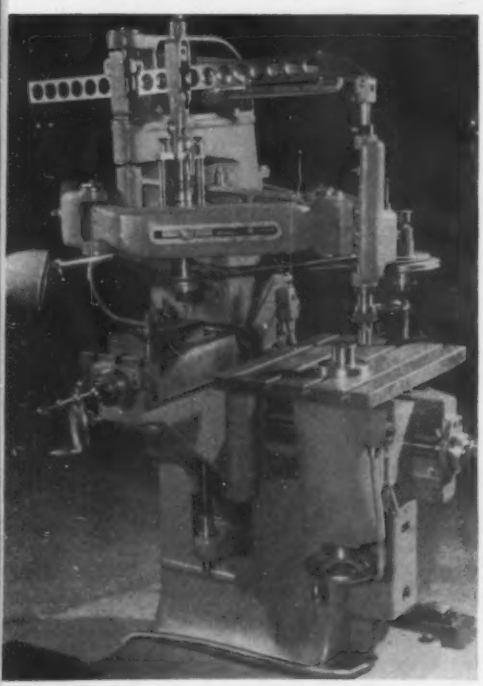
Technical books and periodicals from Russia are now being circulated widely throughout the eastern bloc. At the entrance to the majestic Soviet hall were bookshops selling a wide range of literature on metalworking and other subjects both in

Czech all-electric copy miller claims accuracy to 0.001 in. Roller tracer applies 7-oz pressure, so wax, plater, or other soft masters can be used. Tables can rotate only when tracer contacts model, and right- or left-hand copies can be made



Czeschoslovak radial drill has 13-ft arm carried in guide channels on the swiveling column. Radial movement of arm is controlled manually, but braking and clamping are by push-button. Speeds of 4-in. spindle can be preselected in three ranges from 11.2 to 1000 rpm. Spindle, clutch, brake, and reverse are controlled by single lever

Chinese-built contour milling and engraving machine has eight scale adjustments from 8:1 to 1½:1. Max milling depth at 2:1 is ¾ in. All hinged joints are carried in ball bearings. Machine was first made last year in Qung-Ming, Yunan province



LEIPZIG FAIR (continued)

the original Russian and in German translations.

Judging by the East German machine tool exhibition, that part of the country is moving ahead with the production of machines which formerly were made only in the Western zones. A pair of internal and external grinders for ball grooves in small bearing races, was one evidence of this, as was a big horizontal boring mill with 250-mm spindle, several semi-automatic production and copying lathes, and a variety of fine boring machines. A 47-ton 6-meter OD bearing race for a rotary cement kiln, displayed outdoors among the heavy machinery, testified to the size of boring mills now being made.

Induction hardening equipment is receiving increasing emphasis in eastern Germany—there were automatic cycling units for high-frequency hardening and quenching of camshafts, spindles, and helical gears, and for pre-heating bars in series for forging, with constant temperatures maintained by means of a color-sensitive photometer.

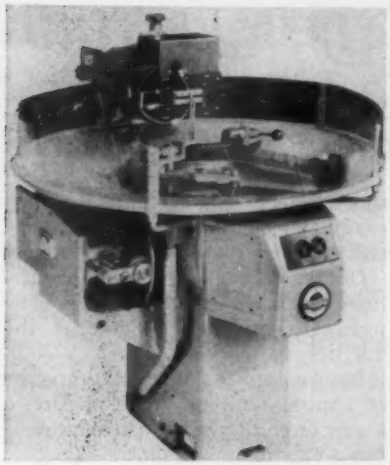
While these machines were from nationalized factories, a number of private firms were also exhibiting. The Government of the German Democratic Republic is apparently encouraging the smaller manufacturers to push on with new designs, and several interesting ones were on show. For example, a universal tool grinder made at the Gotha factory of Looss and Hempel has a work table rolling on balls, a tilting head for grinding raked cutting teeth, and hand wheels duplicated at the back of the machine.

Many non-Communist buyers found their way to Leipzig, and sales to Turkey, Egypt, Argentina, Italy and Holland were mentioned during the fair. One Dutch importer of East German and Czech machine tools, spelled out his views on the effect of Western restrictions on the export of machine tools to the Communists.

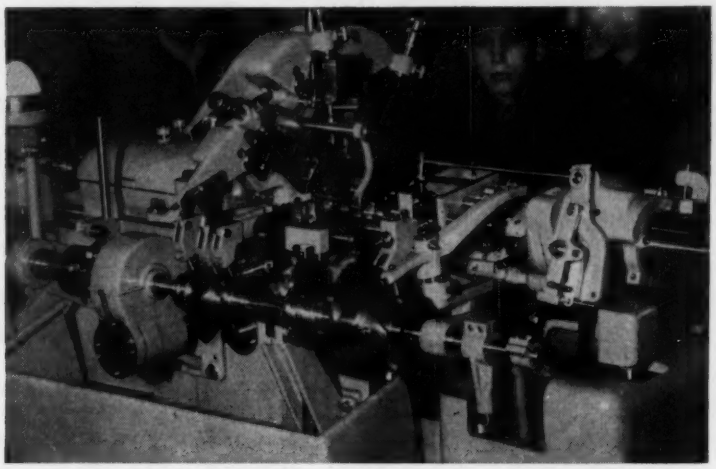
Speaking from intimate commercial experience of the industries of eastern Europe, he stated that "the embargo is hampering production in these countries quite a lot. Because they are compelled to develop or copy these machines themselves, their designers cannot make improvements in their normal types of machines.

"But," he continued, "this will only be for a couple of years." As soon as they have finished a copy or a special development, they will manufacture it in great quantities not only for themselves but for export. "They will start selling these to the West, giving the western manufacturers of these machines big competition."

A number of West German manu-



Induction hardening machine from East Germany designed for connecting-rod crankshaft bearings. Rod swings around with fast infeed until heating coil is reached, rotates slowly during heat and quench, returns fast to unload position



First single-spindle Polish automatic has five cross-slides and three end-working spindles carried on rocking head. All tools are clamped by a single screw for quick change, adjustable in two directions by individual micrometers. Capacity is ¼ in., turning length 3 in. A ½-in. model is also made. Prototype of these machines was developed 18 months ago, and both are now in quantity production with 5 to 6-month delivery

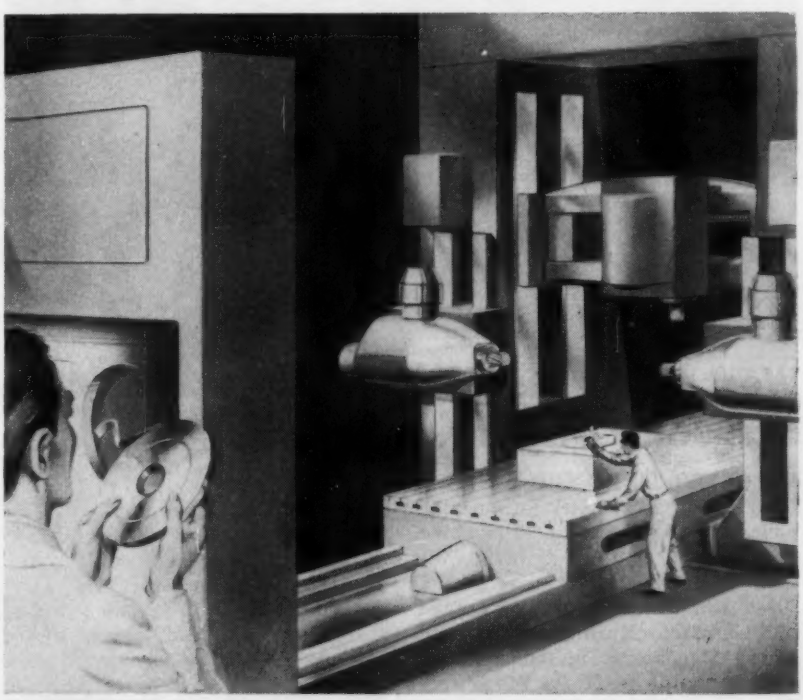
facturers and dealers shared the machine tool hall with their eastern compatriots. With an eye to Communist markets, 28 firms exhibited. Engineering and metallurgy formed the bulk of the 1,600 West German displays at Leipzig this year (against 1,120 last September.

Hartford Buys Out Rockwell Drill Line

HARTFORD, CONN—The complete line of Rockwell (Delta-Milwaukee) hydraulic drill units has been taken over by the Hartford Special Machinery Co from the Rockwell Mfg, Pittsburgh, and will be produced in the former's new Simsbury, Conn, plant. Key sales engineering and production personnel of Rockwell's Drill Unit Division have been retained by Hartford.

The new acquisition rounds out Hartford's present line of mechanical and hydraulic drill units and lead-screw tapping units. It adds an important component to Hartford Special's plan of making it possible for manufacturers to build their own high-production, special-purpose machines by supplying them with the basic components, such as power units, bases and index tables. Hartford Special is broadening its market by supplying either complete machines or machine components for assembly by the purchaser.

Convair to Develop Electronic Milling Machine for the Air Force



THIS 200-TON ELECTRONICALLY CONTROLLED MILLING MACHINE, to be developed by Convair San Diego under a $1,128,000 Air Force contract will be capable of producing aircraft parts or dies of any shape within the second degree curves embodied in modern aircraft. Electronic system reads numerical commands from engineering data fed into a computer, translates them onto magnetic tape, runs them through an electronic director to guide the machine's four cutting heads, bed and turntable. Machine can make up to 18 motions

BUSINESS ETHICS:

Congressmen Asks Probe of Speculative Buying Wave

Connecticut's Dodd introduces bill designed to curb financial speculators' invasion of Metalworking defense firms

WASHINGTON — A commission on ethical financial practices would be created by a bill introduced in the House by Congressman Thomas J Dodd of Connecticut. The Commission, comprising 12 members, would be empowered to make a report to Congress by June 30, and a final report not later than December 31 on what should be done "to promote the protection of the productive capacity, the workers and shareholders in industries directly or indirectly essential to the national defense." Congressman Dodd represents the District within which Niles-Bement-Pond Co, West Hartford, is located. The present N-B-P management has been engaged in a tense contest to prevent Penn-Texas Corp, headed by L D Silberstein, and its allies from gaining control of the company at the stockholders' annual meeting April 6.

Representative Dodd's bill provides that the commission do these things:

Recommend methods and procedures for protecting defense productive capacity, workers and shareholders "against unfair or unreasonable speculative financial activities."

Obtain data about recent acqusitions or attempts to acquire control of companies in defense industries.

Secure information about sources of capital — foreign or domestic — credit or equity, used in such acqusitions, or attempts to do the same.

Determine the efficiency and effectiveness of executive agencies and regulatory commissions charged with protecting such productive capacity, workers and shareholders.

Re-define responsibilities of federal officials charged with this job.

Establish appropriate codes of financial ethics.

Four of the commision members would be appointed by the President, four by the Speaker of the House, and four by the majority leader of the Senate. The commission would consist of two U S Senators, two Congressmen, two men from federal executive agencies, and six from private life.

In asking Congress to pass his bill, Rep Dodd raised this caution, "We must endeavor to draw a line between those cases which represent the normal pushing and hauling among financial interests with perfectly legitimate and constructive purposes—as against the vulture-like raids which are made to milk a company or to cause its liquidation."

It seems unlikely that Rep Dodd's bill will be enacted into law. It has been referred to a House committee, where no action is expected.

West Coast Distributors' Showroom Has Joint Display of Machine Tools

REPORTED TO BE THE BIGGEST DISTRIBUTORS' SHOW of machine tools, a display of some 80 machine tools, valued at upwards of $1 million, inaugurated the opening of a 20,000-sq ft building jointly occupied by Germain Machinery Co and Moore Machinery Co (consolidated into Germain and Moore Machinery Companies—with joint executive and sales staffs). Some 2500 customers attended the five-day exhibition, billed as the "Western Preview of the Machine Tool Show," and saw a number of machine tools never before shown. The Germain-Moore combine displayed the machine tools of the following firms it represents in the California - Arizona - Nevada area: Barnes Drill Co, Chambersburg Engineering Co, Buffalo Forge Co, Carlton Machine Tool Co, Cincinnati Shaper Co, Giddings & Lewis Machine Tool Co, George Gorton Machinery Co, Heald Machinery Co, Jones & Lamson Machinery Co, Kearney & Trecker Corp, Landis Machinery Co Lapointe Machine Tool Co, Monarch Machine Tool Co, National Automatic Tool Co, Norton Co, Peerless Machinery Co, and Clearing Machinery Corp.

FORM DIE-CASTING ENGINEERS' SOCIETY

DETROIT—The Society of Die-Casting Engineers has been formed here to "foster and further technological advances in the field of die casting and finishing of metals, and die molding of plastics and powdered metals." First chaper has been set up here with Harris Shimel of Chevrolet-Bay City as president. National offices and headquarters of the Society will be located at 19370 James Couzens Highway, Detroit 35.

AMTDA MEETS AT WHITE SULPHUR:

The Machine Tool Show Will Be a Real Challenge

The forthcoming Machine Tool Show cropped up again and again at the Machine Tool Distributors' spring meeting. It's a once-in-several-years' chance for the builders and distributors to get together with the men who buy machine tools — especially timely in an era when replacement is of paramount importance

WHITE SULPHUR SPRINGS, W Va —"Better selling" was the theme of the 31st spring meeting of the American Machine Tool Distributors' Association at The Greenbrier March 24-25. President Raymond Vidinghoff invited three outside speakers to discuss various aspects of selling and of sales training. In addition, he had arranged for two panel discussions that proved to be a popular innovation. A panel on "The New Salesman" was presided over by J O Ellison, Harron, Rickard & McCone Co of Northern California; and the panel on "Office Management" by Henry R Hanson, William K Stamets Co.

References to the Machine Tool Show in Chicago in September ran repeatedly through the meeting. Mr Vidinghoff pointed out that the show will be a challenge to distributors as well as to builders and that the association has arranged a publicity program for the show to supplement that of the builders. He urged all distributors to be at the show with their sales engineers for the duration and to spend a day or two at the booth of each manufacturer represented. He declared that never has the relationship between distributors and builders been better than now.

Tremendous Replacement Market

Mr Vidinghoff stressed the tremendous replacement market for machine tools as revealed in the seventh American Machinist Inventory of Metalworking Production Equipment (more than 1 million of the nation's machine tools were shown to be 10 years old or older). He mentioned the Navy's program of finding out how many obsolete machines it has in its yards and then applying the yardstick of savings made by replacing them with new machines, thus justifying Congressional appropriations for purchase of new machines. Other armed services probably will follow the Navy's lead in appraising the value of replacing their old tools.

"Spending for Profit"

Machine tool buyers are purchasing "the effective use of invested capital" and are "spending for profit," M A Hollengreen, president Landis Tool Co and president National Machine Tool Builders' Association, said. "The mechanical improvements, electronic controls, improved devices for automation and even the gadgets may arouse the enthusiasm of the operating man, but they mean very little unless they can be translated into financial savings for the benefit of the financial man."

These benefits interest the financial man, Mr Hollengreen stated: 1) increased output per manhour; 2) reduced overhead through greater safety, lower maintenance, scrap reduction, lowered downtime, savings in floor space, better operating morale, elimination of operations, faster assembly of finished product; 3) improvement in product to get a competitive advantage or in new products to achieve diversification; 4) rapid recovery of his investment in new machines in the form of taxes.

AMTDA PRESIDENT Raymond Vidinghoff, who presided and was keynote speaker at AMTDA's 31st spring meeting

Mr Hollengreen hammered home the idea that "the worst cost we have to bear is almost always the money we do not spend." Machine tool users should not be "penny wise and pound foolish." The Machine Tool Show will set off a chain reaction of replacement that will multiply with the ensuing years. The best way to sell a machine tool is to demonstrate it in operation on a plant floor. "The whole concept of the Machine Tool Show is actual demonstration of many machines before all possible customers at one convenient central location."

Builder-Distributor Liaison

Machine tools are being built better and sold and distributed more effectively today than ever before as a result of the close bond and understanding between builders and distributors, Mr Hollengreen declared. Much of this progress stems from the effective work programs of the two associations, the AMTDA and the NMTBA.

"As long as we retain preeminence in design, nobody but nobody can have a machine tool industry like ours," Tell Berna, general manager NMTBA, said. The sales engineer who thinks that he can do a better job is important to the industry. The industry's reliance for prosperity gets back, in the end, to the individual salesman. Upon his efforts depends whether the industry goes up or slides down.

New Tool Orders Are Up

The industry booked about $60 million of new orders in December, Mr Berna reported. January and February were about on a par with December. He estimated that the federal government will place $145-$160 million of machine tool orders; but these orders will not be felt by the industry until late this year and in 1956. It is doubtful whether any of the reserve machine tools ordered

AMTDA MEETING (continued)

will be shipped until the latter part of next year.

Renegotiation probably will be continued by Congress for another two years, Thomas R Rudel, president Rudel Machinery Co Inc and chairman government relations committee, predicted. Most of the distributors have now been cleared in renegotiation proceedings for 1951 and 1952, he said. He introduced various subcommittee chairmen who presented brief reports.

Screen Surplus US Tools

Continued screening of government surplus machine tools, to find out what should be retained and what should be scrapped, was urged by Mr Hanson, reporting for the subcommittee on permanent defense capacity. He said that Air Force holdings at Omaha, Neb, and Marietta, Ga., have recently been surveyed by a team partly comprised of machine tool distributors. The Defense Department, he said, is grateful for this assistance. He expressed satisfaction over the future planing on machine tool mobilization needs being done by government agencies.

The bill that failed

Few people realize that the more rapid depreciation formulas for production equipment, namely the sum-of-the-digits method and the double - declining - balance method, just escaped being casualties as a result of the narrow defeat of the tax revision bill sponsored by the Democrats, Joseph F Owens Jr, J F Owens Machinery Co, stated. He said that the machine tool industry has been asked to help the Treasury Department revise the useful life of machines and the classification of machine tools in the controversial Bulletin F of the Internal Revenue Department.

The Machine Tool Show

Frank Habicht, Marshall & Huschart Machinery Co, outlined the services that the AMTDA expects to render at the Machine Tool Show. He expressed the belief that visitors will have less trouble getting hotel rooms this year than in 1947 because no preview day is scheduled. There is ample provision for advance registration. Some 3000 automobiles can be accommodated in the parking lots adjoining the show buildings. The objective, he stated, is to double the number of visitors in September compared with the previous show (75,000 in 1947).

First Punch-Tape-Operated Boring Machine

Standard four-spindle Excello borer . . . Precision boring machine (upper right) is modified with built-in electrical controls, circuitry, tape reader and manual controls housed in control cabinet (left). Operator (foreground) is punching hole coordinates on tape

is tape-fed electronic signals . . . Coordinates punched on tape are fed into reader mechanism. Control knobs adjust linear travel, rotary motion

MINNEAPOLIS—Believed to be the first successful application of the punched-tape principle of automatic operation to a precision boring machine is a system developed by Minneapolis-Honeywell Regulator Co to convert a standard, four-spindle Excello boring machine to the automatic production of instrument-gear trains.

The tape - controlled precision borer, according to a company spokesman, is ideally suited for medium-sized production lots and "tooling and setup costs are substantially lower than for punch-press piercing dies or drill-ream jigs—and operating costs are less than for jig borers." Tape preparation requires about 5 minutes per hole; complete changeover from one part to another

New Standards for Stub Taps Developed By NSMPA Gain Wide Member Acceptance

CLEVELAND — New standards for stub taps, developed by a committee of the National Screw Machine Products Association, have gained widespread acceptance among NSMPA member companies, according to Committee Chairman C J Baumgart, Screw Machine Engineering Co, Chicago.

Shorter Taps

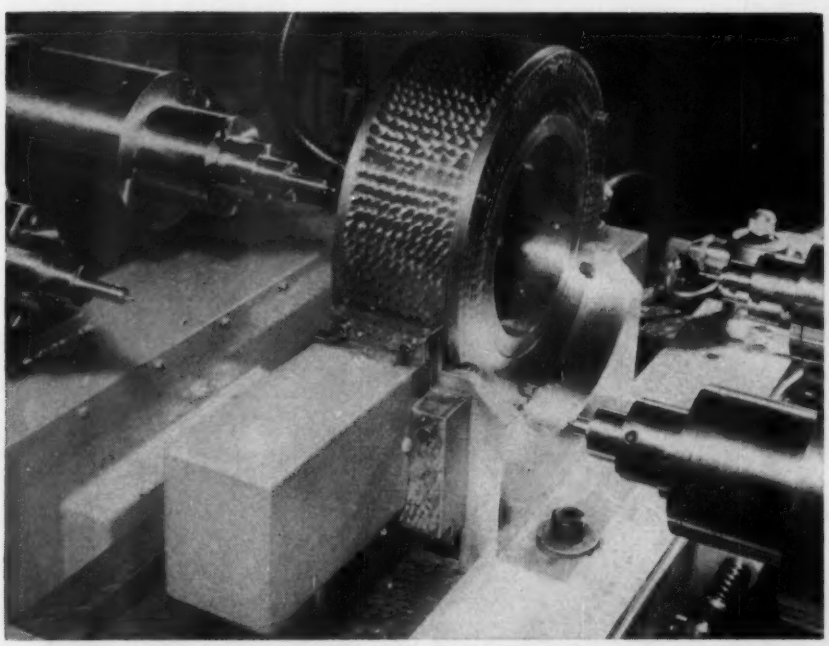
The new standards decrease the overall length of the tap, with the shank of the tap made to the nominal OD of the tap. Shank diameters will be ground concentric with threaded portions to insure alignment. Standardization of shank diameters will eliminate special-size bushings. And squares on the tap will be eliminated, except for two small flats on the ends of the shank to be used as a driving surface in making the taps. Elimination of the conventional long-squared portion of the taps will give greater bearing surface in the bushings—thus improving alignment between tap and work and guaranteeing better holding power.

The new stub tap is ready for use, thus saving setup time. Having a perfect concentric shank, it fits standard bushings. And the new tap will have a perfect factory-ground chamfer, will be stronger and more economical. The new stub tap does not attempt to change existing tap standards. Rather, these standards are intended to supplement existing standards with an additional line of taps that improve convenience and accuracy, extend tap life, and permit automatic screw machine tap users to insert them into machines without alterations.

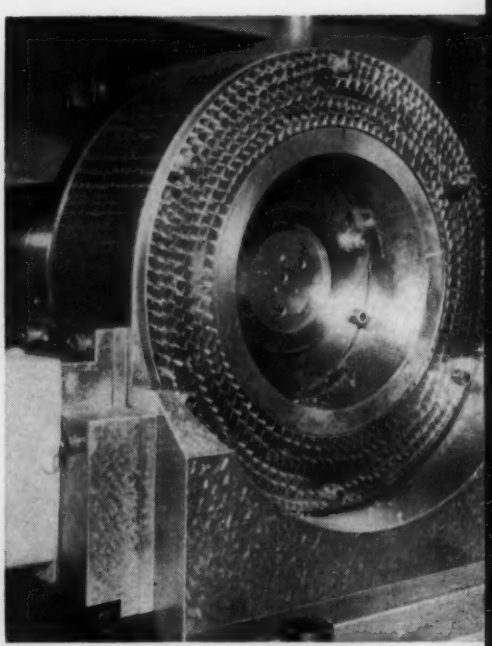
Available in June

The new taps are in production at Besly-Welles Corp, Beloit, Wis, and will be available in June. Engineers of that firm have worked closely with NSMPA's committee in their development.

Cuts Gear-Train Production Costs



that control linear travel and rotary motion . . .
Loop plastic tape sends out impulses to regulate linear travel of crossslide (lower left) and rotary motion of holding fixture (center). After complete tape has been read, machine stops to permit finished-part removal



to bore shaft holes in gear plates
Machine achieves tolerances to plus or minus 0.005 in., preventing binding or backlash

can be accomplished in about half an hour. Setup is done this way: (1) adapter ring is attached to rotary fixture, (2) cutting tools are mounted in the four spindles, (3) punched tape is placed in reader of control circuit, (4) blank is inserted in fixture, and (5) operator presses button to start operation. Machine stops automatically when all of tape has been read. Pieces can be changed by putting in a new adapter ring and feeding in a different tape. When a small number of special plates is needed, machine can be manually operated by adjusting 10 knobs to control linear travel of cross-slide and rotary motion of the holding fixture. Information is fed in increments of 0.0001 in. over linear range, and 0.01 degrees over rotary.

GE'S FABULOUS "BUILDING 85":

Townspeople Get a Look at $7-Million Worth of Mechanization

SCHENECTADY—General Electric's hush-hush Building 85, housing its completely new 7½- to 30-hp electric motor plant, has at last been described in local newspapers—as a result of an open house for some 2000 employee families and community leaders March 19.

Design of Building 85 began about three years ago, and the plant has been in service for the past six months, replacing a line at Lynn, Mass, doubling capacity by incorporating the latest ideas in fabrication and assembly. Cost of modernization was over $7 million.

Speaking at the employee open house, Olaf F Vea, general manager of the Medium Induction Motor Dept, pointed out that the building symbolizes a "step in the elevation of the American working man from laborer to technician." In replying to union criticisms that such mechanization displaces workers, Vea said: "A recent survey found that one person in every five owes his job to products GE didn't make nine years ago. This means that new products have created 45,000 new jobs at GE since 1945."

More people are now employed in Building 85 than when it was used by the cable department. There are three assembly lines, two on standard motors, one on specials. According to newspaper reports, laminations are punched in two presses connected by magnetized underfloor belt conveyors, then stacked, insulated, and welded in a continuous furnace process. Frames are machined in other auto-units, as is assembly except for inserting coils. Even the floor sweeper is motorized. (Only article describing elements of the new setup was in *AM* for Dec 20 '54, p 110-112.)

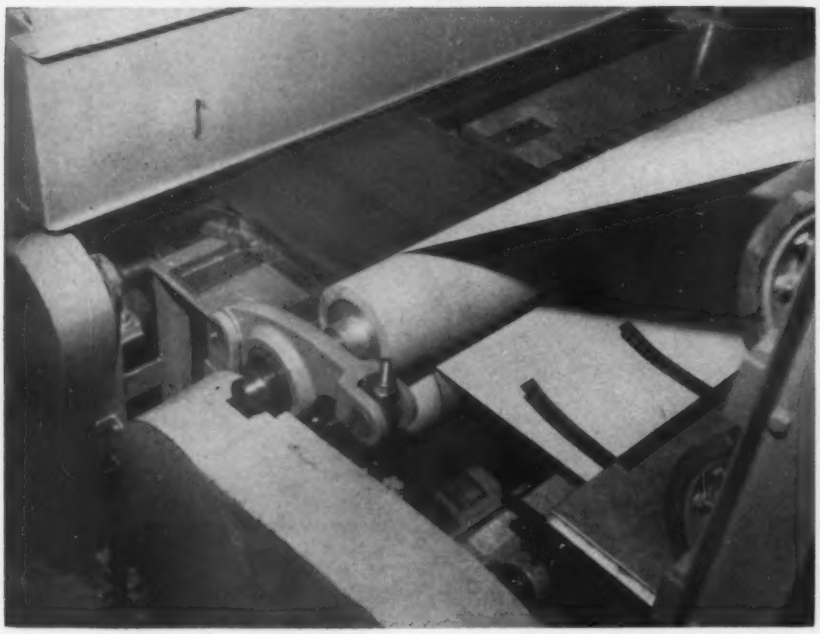
In describing the setup, Mr Vea said:

"Right now the machines we have been using for building motors are 20 to 30 years outdated. All we have done here is introduce machines which men can use to build the kind of motors our industry demands today. The automobile industry is much more mechanized . . . yet now employs far more people than it did 20 years ago.

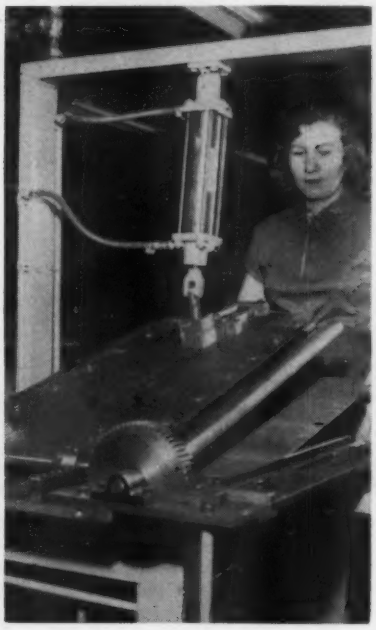
"We will never be able to eliminate people. We need them now and we will continue to need them in increasing numbers . . . and as we shift our emphasis from one type of job to another we will help our employes move into the newer jobs.

"Improved machinery means very real benefits to employes. You may wonder as you watch the men at their machines whether the new machinery makes their jobs more routine and less interesting. I think I am speaking for most of the men when I say that mechanization helps provide greater job variety and stimulation. Even maintenance jobs become more interesting."

Plastic-Magnesium Sandwich Makes Suitcases



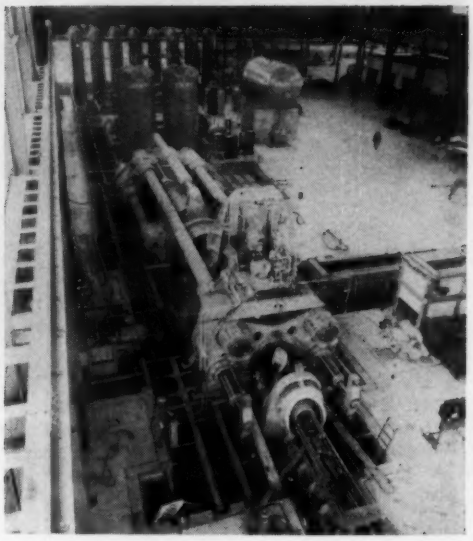
Magnesium and vinyl wedded here . . .



. . . are bent as one

Key stage in production of magnesium suitcases is the bonding of a decorative vinyl coating to the magnesium. Sheet magnesium is heated in oven to 350 F. Vinyl sheet is coated with Marvinol adhesive and rolled on the magnesium as the latter leaves the oven. Special laminating process developed by Dow and Shwayder Brothers can be also applied to coil magnesium. Bond is so tight that separating the two tears out metal. Bonded product is punched, sheared, and formed like any sheet metal to produce new Samsonite luggage. Hardware is made from aluminum die castings anodized to a gold color

Plymouth tools new engine plant . . .
for Detroit operation by fall of '55. Plant will triple Plymouth V-8 engine output, will consist of old Mound Road plant plus a new addition



. . . and Curtiss-Wright gets a new press
World's biggest (12,000 ton) horizontal steel extrusion press will extrude steels, titanium and non-ferrous alloys for Air Force at Curtiss-Wright Buffalo

Companies in the News . . .

Titanium Metals Corp of America has cut titanium prices: 55¢ less per lb for sponge to $3.95; mill products —sheet, strip, bar, billet, wire and plate—$1 to $3 less per lb. Reason: more efficient and sustained output.

Boeing Airplane Co is cutting its Wichita, Kansas, plant workforce from 29,000 to 25,500. Reason is a cutback as B-47 output phases out. Workforce will again build up as B-52 output grows.

North American Aviation Inc is developing the SM-64 "Navaho" long-range surface-to-surface guided missile at its Downey, Calif, plant.

Pittsburgh Gear Co has installed $150,000 worth of heat-treating equpiment to enable it to case-harden gears as large as 72-in. dia with face width of 30 in. and a maximum load of 8500 lb.

Olin Mathieson Chemical Corp expects its new East Alton, Ill, roll bond plant to be finished by spring.

Harvey Machine Co, Torrance, Calif, has been awarded a $1.3-million contract to make 2.4-million 40-mm projectiles for the Navy.

General Electric Co plans to build a $15-million home cooling equipment plant at Tyler, Texas. Completion of the 350,000-sq-ft plant is slated for fall of 1956.

Twin Coach Co, Kent, Ohio, is negotiating for purchase of **Davey Compressor Co** of that city, plans to make it a subsidiary.

Borg-Warner Corp's Ingersoll-Kalamazoo Division has acquired **Brooks Equipment & Mfg Co,** Noxville, Tenn, maker of materials handling equipment, and will operate it as a subsidiary.

Cleveland Automatic Machine Tool Co is negotiating for purchase of **J H Day Co, Inc,** Cincinnati maker of food processing machinery. At present, Cleveland Automatic has a 30-day option to buy all outstanding Day common stock for an undisclosed price. Day would be operated as a subsidiary.

National Radiator Co and **U S Radiator Corp** stockholders have approved a merger of the two companies.

Thompson Products Inc, Cleveland, is buying White Motor Co's 370,000-sq-ft Cleveland plant for $3 million, will use it to relieve manufacturing-space pressure at its Tapco plant in Euclid, Ohio.

General Electric Co has received cancellation orders for 1500 jet engines from the Air Force. Reason: engines on hand are lasting longer than expected, and fewer need be stockpiled.

Westinghouse Electric Corp has shipped its first automatic anti-aircraft guns to the Navy under a $33-million contract.

General Motors Corp's Allison Division plans to spend $75 million in the next four years for facilities for the development and testing of turbojet and turboprop aircraft, both military and civilian. Allison will construct an addition to its engineering facilities and an addition to its model shop and assembly plant near Indianapolis. This enlarges development space from 500,000 sq ft to nearly 1-million sq ft.

American Locomotive Co, Schenectady, has acquired the **Carter Craft** fin tube process of heliarc welding longitudinal fins to tubes for heat exchangers.

American Brass Co will build a $13-million copper sheet, strip, rod and tubing mill in Los Angeles County. It will employ 500.

Western Electric Co Inc has been selected by the Air Force as prime contractor for the Distant Early Warning Line.

Peerless Electric Co, Warren, Ohio, will break ground this month for a $350,000 plant to house its Fan & Blower Division.

Scovill Mfg Co, Waterbury, Conn, is acquiring **DeLong Hook & Eye Co,** Philadelphia, will continue its present output.

WARNER & SWASEY CO ELECTIONS ... Walter K Bailey (left), vice president, manufacturing, to president, succeeding **Chas J Stilwell**, head of the company since 1939, named chairman of the board

Ben H Ward, assistant treasurer of Lees-Bradner Co, Cleveland, has been appointed manager of the company's Factory Division

Names in the News . . .

Frank L Marshall, formerly vice president and general manager of Mayhew Steel Products, Inc, Shelburne Falls, Mass, has been appointed sales manager of Utica Drop Forge & Tool Corp's Tool Division.

Edward C Conner, production control manager of Walworth Co, New York, has been appointed works manager of the company's Greensburg, Pa, Works. He succeeds **Carl F Lundbom,** who has retired after 43 years' service with the organization.

Chrysler Corp changes: **Hayward F York,** operating manager of the Detroit Tank Plant, to a similar post at the Jet Engine Plant; and **William M Williams,** formerly executive assistant to Mr York, to succeed him.

John S Davey, assistant general sales manager, has been promoted to vice president of Russell, Burdsall & Ward Bolt and Nut Co, Port Chester, NY.

M Harry Pendergast, president of Maumee Machine & Tool Corp, Toledo, Ohio, has been elected president of Air-Way Industries, Inc, Toledo. He succeeds **Joseph H Nuffer,** named chairman of the board. **Dewey M Dow** has been appointed vice president, manufacturing.

American Machine & Foundry Co names new vice presidents: **Tad Stanwick, Robert W Kerr,** and **Frank P Downey.** The three men have been serving as group executives, and will continue in that capacity.

J B Sewell, general sales manager of Garlock Packing Co, Palmyra, NY, has been elected a vice president. He will continue to direct sales in the US and in Canada through the Canadian subsidiary.

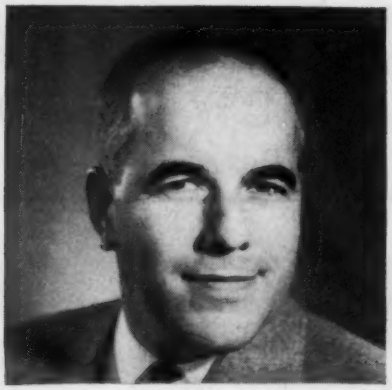
Robert B Murray, Jr, recently resigned Under Secretary of Commerce for Transportation, has been appointed special assistant to the president of the Baldwin-Lima-Hamilton Corp, New York. Mr. Murray will make his headquarters in Philadelphia.

Roy L Blanchard, vice president, operations, of Beaver Precision Products, Clawson, Mich, has been elected president and general manager. He succeeds **Aubrey E Streadwick,** who has resigned as chief executive, and will continue as a director of the company.

Franklin Farrel III, executive vice president of Farrel-Birmingham Co, has been elected president to succeed **Franklin R Hoadley,** retiring May 1.

Joseph A Geuss, engineering supervisor at Clearing Machine Corp's Chicago plant, has been appointed chief engineer of the Hamilton, Ohio, plant

D Pierson Smith, assistant secretary and treasurer of National Broach & Machine Co, Detroit, has been elected vice president, sales



MICROMATIC HONE APPOINTS . . . Don S Connor (left), executive vice president, to the additional post of general manager; **William H Harris, Jr,** vice president, engineering, to vice president and assistant general manager (*AM* March 28, p163)

William Taylor, purchasing agent for Detroit Bevel Gear Co, has been named assistant to the president, in charge of operations

American Society of Tool Engineers elects national officers; **Dr Harry B Osborn, Jr,** technical director of Ohio Crankshaft Co's Tocco Division, named president to succeed **Joseph P Crosby,** vice president of Lapointe Machine Tool Co, Hudson, Mass; **H C McMillen,** plant manager, Philco Corp, Bedford, Ind, first vice president; **H E Collins,** manager, process engineering department, Hughes Tool Co, Houston, Texas, second vice president; **R C W Peterson,** president, Peterson Engineering Co, Toledo, Ohio, third vice president; **Wayne Ewing,** president, Arrowsmith Tool & Die Co, Los Angeles, Calif, fourth vice president; **Harold D Long,** president, Scully-Jones & Co, Chicago, treasurer; and **John X Ryneska,** General Electric Co, West Lynn Mass, secretary. The Society's first honor awards went to: **Ernest R Breech,** Ford Motor Co's board chairman — the ASTE Progress Award as "foremost manufacturing executive . . ."; **Philip M McKenna,** president of Kennametal, Inc, Latrobe, Pa, — the ASTE engineering citation for ". . . contributions to the development of carbide materials and tools and their application . . ."; **O B Jones,** president and founder of the Detroit College of Applied Science,—the Joseph A Siegel Memorial Award for outstanding contributions to the Society.

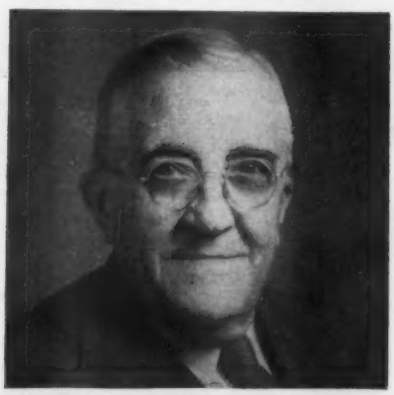
Firth-Loach Metals Inc, McKeesport, Pa, appoints: **Harold O Warnock,** formerly chief engineer of research department in charge of testing at Firth-Sterling, to the post of chief plant engineer; and **Jack H Powers,** former superintendent of X-ray Diffraction and Metallographic Laboratories at Firth-Sterling, to superintendent of X-ray & Metallography.

Robert G Hess, manager of the Worcester Division of the Washburn Co of Worcester, Mass, and Rockford, Ill, has been named general manager of the company and its subsidiaries. He succeeds **John S Tomajan,** who continues as Washburn and Michigan Wire Goods Co president, and as chairman of the board of Andrews Wire Works of Canada Ltd, Watford Ontario. **Albert L Zuck,** assistant manager of the Worcester Division, takes over Mr Hess's post.

Lunkenheimer Co, Cincinnati, Ohio, appointments: **Eibe W Deck,** formerly vice president and works manager of Wico Electric Co, West Springfield, Mass, to vice president, production; **Earl F Riopelle,** former vice president, engineering, of Houdaille-Hershey Corp, Detroit, to vice president, engineering and research; **Chester C Isekeit,** treasurer and controller, to vice president and treasurer; and **Melvin W Pauly** general sales manager, to vice president, sales.

Joseph I Bosi, associated for the past five years with the Hydro-Line Manufacturing Co, Rockford, Ill, has been appointed chief engineer.

Keith Sorenson, chief engineer of Air Equipment Co, Los Angeles, Calif, has been named vice president-engineer.



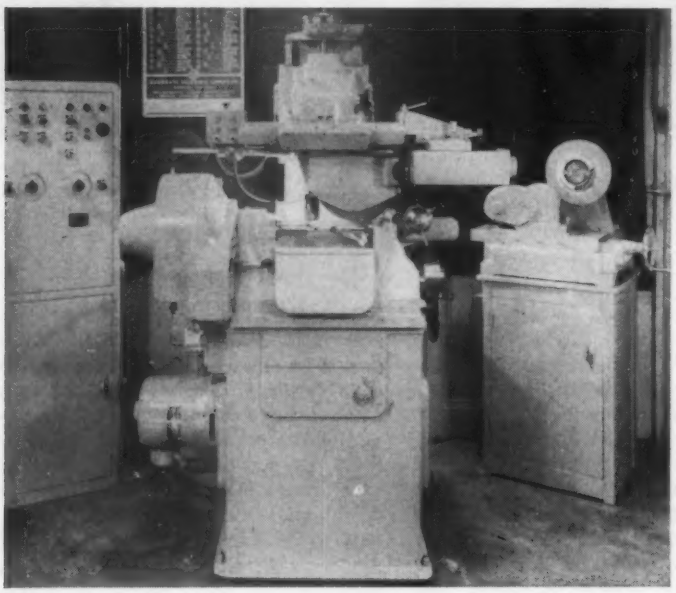
Fred H Colvin, editor emeritus of *American Machinist,* has been awarded the 1955 ASTE Gold Medal for outstanding contributions to industrial progress during his 69-year career as author and editor

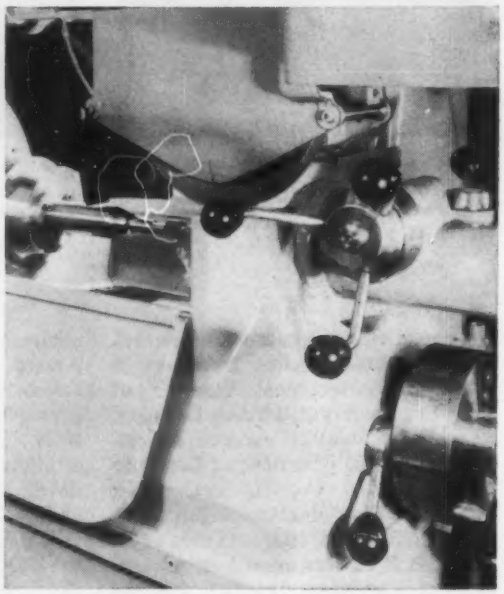
Vincent E Lysaght, divisional manager of the Helicoid, Campbell Machine and Wilson divisions of American Chain & Cable, New York, has been appointed general sales manager of the company

OBITUARY

Hannibal Choate Ford, 77, founder of the Ford Instrument Co, New York, and inventor of the first mechanical control-computer for naval gunfire, died March 12 at his home on Long Island, NY.

New Shop Equipment,





Automatic Grinder Handles Spur and Helical Gears

Belock has completed development of a fully automatic precision gear grinder for spur and helical gears. Although a high-production machine, it was designed to make short runs economically feasible.

Expensive tooling has been eliminated. A special involute dial is set to proper index number to produce involute shape for particular size gear to be ground. Three change gears are selected for the number of teeth on the gear and the proper dressing cam is inserted in the diamond dresser. It is stated that a complete setup can be made in 60 minutes compared with eight hours on some other machines.

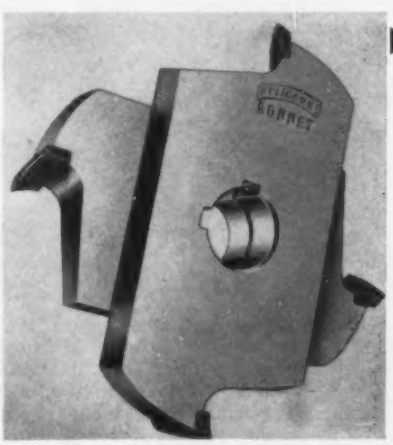
Operating cycles are programmed on the control console. One operator can tend several machines—simplicity of design eliminates the necessity of specially trained personnel. All hydraulic, electrical, and mechanical components are located to make servicing fast and simple.

Automatic dress interval is set on the control console to eliminate judgment error. At end of preset interval, grinding wheel automatically positions itself for dressing and light goes on to signal operator who sets amount of dressing on dial and turns a lever to start operation requiring about 30 sec.

Capacity of machine is ¾ to 7½-in. pitch dia and it will handle 4 to 32 pitch. Grinder is 48x36x70 in. high; total power consumption is less than 1.7 hp.

The tooth form is generated with a single grinding wheel on which multiple annular rack gear forms have been dressed. These gear forms are in varying diameters so that in one pass of the worktable several teeth are generated progressively in rough, semi-finished, and finished form. Root fillet radii can be ground as a continuous part of flank grinding.

Belock Instrument Corp, College Point, NY



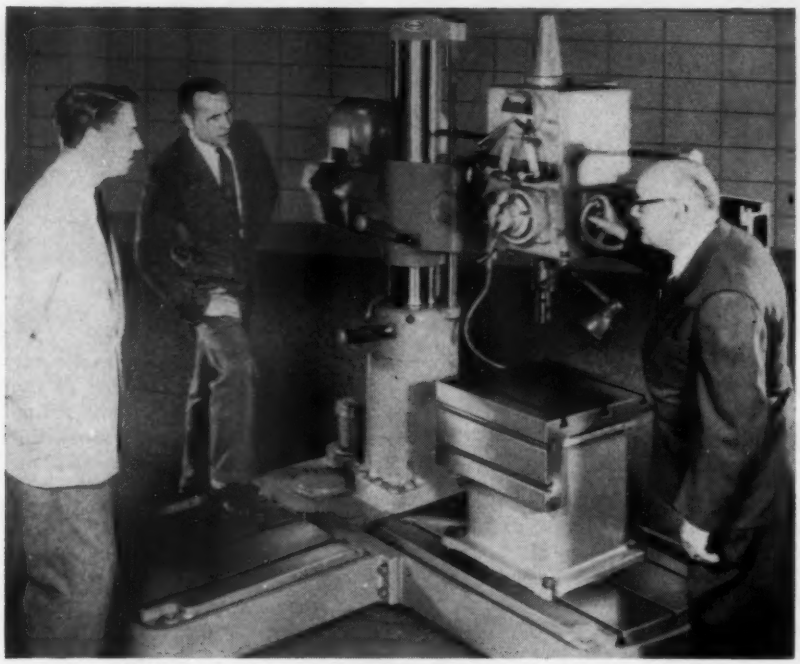
▶Stagger-Tooth Side Mills

Standard stagger-tooth side milling cutters, and interlocking side or straddle mills in various sizes have been added to the Helicarb line.

Four-tooth design provides adequate chip load to accommodate milling machines without high speed spindles and fast table feeds. Double keyways permit several cutters to be interlocked, or spaced for straddle milling. Standard cutters available in RH and LH, half-side-mills, and have 25° true helix teeth.

Sonnet Tool & Mfg Co, 576 N Prairie Ave, Hawthorne, Calif

Materials and Parts . . .



New Cincinnati Radial Drill Has Flame-Hardened Column

Cincinnati reports the first radial drill with flame-hardened column. It is engineered to provide a thick-walled centrifugal casting, accurately turned on high-speed lathes, surface flame-hardened, then finish-ground to close tolerances.

The machine, termed Hardclad, features two-lever, direct-reading, color-match, spindle-speed and feed-shift dials, with all controls grouped in easy reach. Nine spindle speeds and six power feeds are provided, with speed and feed shafts mounted in anti-friction bearings. The alloy steel No. 3 MT spindle is mounted in four anti-friction bearings. The entire internal mechanism is force-spray lubricated by oil pump.

The 1½-hp main drive motor is mounted on arm to left of column, providing counterbalance. Power is transmitted through silent chain and drive shaft—no parts of main drive arrangement are concealed in the head.

Safeguards include electrical panel built into back of arm. The raise-lower pushbuttons are covered by a guard. Stability is provided by the new waffle-ribbed base.

The radial is a 3-ft-arm, 7½-in.-column machine with a drilling capacity of 1½ in. in cast iron. It drills to the center of a 77-in.-dia circle.

Accessories such as coolant, universal or box tables, side bases, and work light are available. Write manufacturer for catalog D-133.

Cincinnati Lathe and Tool Co, Cincinnati 9, Ohio

Electro-Magnetic Chuck

Electro-magnetic chuck, 10 and 12-in. dia, incorporates "Crow-Foot" face pattern with 48 radial magnetic gripping edges equal to 91 lineal inches of magnetic engagement on a 10-in.-dia face. Greater number of radial magnetic lines, and their closeness, produces much stronger grip on work that is ordinarily hard to hold.

Magnetic Holding Devices, 2034 E 22nd St, Cleveland, Ohio

. . . including

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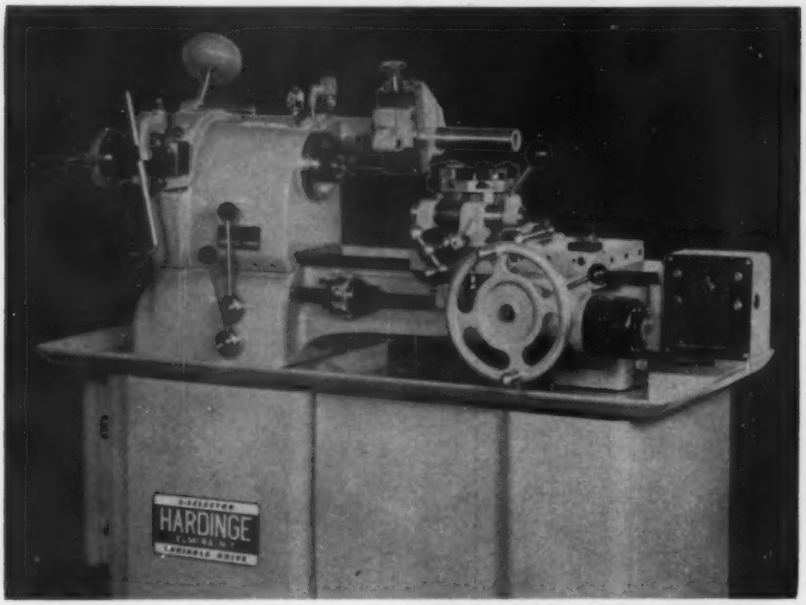
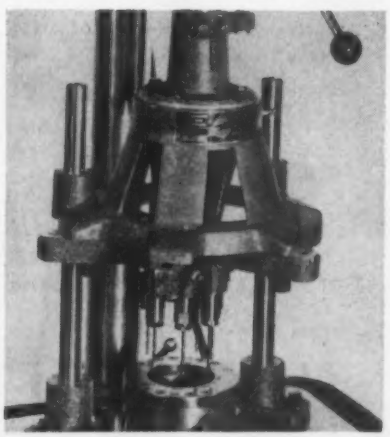


Hardinge Chucking Machine Features Three-Selector Variable Drive

Models HCT and HC chucking machines incorporate a three-position speed control lever at the headstock to permit shifting from one speed to the other without stopping the machine. Any three speeds within the 125 to 3000-rpm range may be preselected by adjusting master cams located inside the motor compartment door.

Model HCT features a single-point production threading head, eliminating the need for large, expensive die heads and collapsible taps and chasers. With one leadscrew and follower, plus a low-cost ⅜-in. square tool bit, any diameter thread of the same pitch can be cut at high production speeds. Model HC is available without the threading head.

Hardinge Brothers, Inc, Elmira, NY



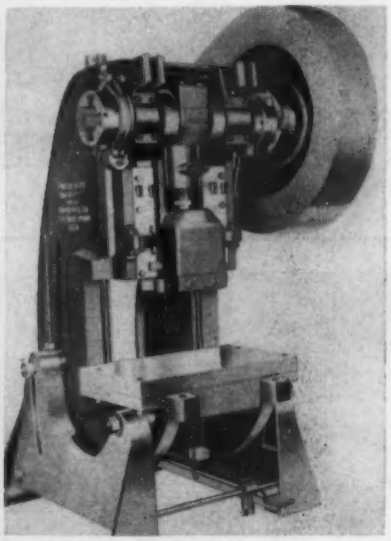
Ettco Tool Multiple Head Driven By Flexible Shaft

Model 600 flexible-shaft-driven adjustable-spindle multiple head is a lightweight unit designed for tapping and drilling up to six holes on any machine. Positioning of spindles is accomplished by adjusting arms moved in or out or transversely while unit is operating. Jig-bored templets can be supplied in place of adjusting arm where fixed-center set-up is desired. Individual shafts, spindles, and adjusting arms are removable as integral units.

Conversion from drilling to tapping merely requires the addition of standard tapping face plate and replacement of drill collets with interchangeable floating tap collets. A 1:1 drive ratio permits the unit to be used for leadscrew tapping. Unit incorporates one-piece hardened and ground grease-lubricated gears in driving head; grooved precision-type ball bearing thrusts for each spindle; hardened and ground guide rods running in bronze bushings in the aluminum alloy head.

Capacities range from 1/32 to 5/16-in. drills in steel and No. 6 to 5/16-in. taps in aluminum. Maximum bolt circle is 6⅞ in. Minimum center distance between spindles is 15/16 in.

Ettco Tool Co, Inc, 594 Johnson Ave, Brooklyn 37, NY



Press-Rite 45-ton Model Has Built-in Steel Tierods

Model No. 45 open-back, inclinable press is a 45-ton unit added to the Press-Rite line. Heavy-duty frame has built-in high tensile steel tierods to reduce deflection and increase die life.

Press is available with single-stroke safety mechanism, cam-actuated automatic brake, and four-point mechanical clutch. If desired, it may be equipped with an Air-flex air-friction - drum - design clutch, and brake with electric controls.

Model has standard stroke of 3-in.; 4-in.-dia crankshaft at main bearings; max stroke of 6 in., with 2-in. adjustment of slide. Bolster area is 20x30 in. With mechanical clutch, standard speed is 90 sfpm; when equipped with air-friction clutch, higher speeds are possible. Over-all height is 69½ in. from floor to center of crankshaft.

Sales Service Machine Tool Co, 2363 University Ave, St Paul 14, Minn

Electronic Industrial Trucks

Guide-O-Matic truck or tractor, requiring neither operator nor physical connection, follows a route set by a guide wire strung from the ceiling. Completely automatic unit moves loads at any speed desired.

Radio waves that control the unit are transmitted over the wires by means of signal boxes installed at desired locations throughout the plant. By pressing a button, truck comes immediately to station from which signal originated.

Guide wire is easily strung from ceiling along desired routes, or it may be laid into a small slot in the floor.

Barrett-Cravens Co, 628 Dundee Rd, Northbrook, Ill

FYI
FOR YOUR INFORMATION

FREE Catalogs, Booklets, Charts, Calculators

FYI – these initials symbolize information that's important. And there is much of importance in the literature listed here. To get the ones you need, all you do is fill out one coupon for each booklet you wish to order. Indicate in the circle on the coupon the number of one catalog wanted. When you have filled out a card, detach, stamp, and mail. We'll do the rest.

MACHINES AND ATTACHMENTS

1 LATHE—*Logan Engineering Co, Chicago 30, Ill.* 4-page bulletin 14-L contains illustrated data on 14-in. Model 6560 with variable speed drive, speeds up to 1200 rpm, 40-in. center distance. Specifications, accessories and attachments included.

2 GAP PRESSES—*Minster Machine Co, Minster, Ohio.* 12-page illustrated bulletin covers G1 Series of fabricated steel units from 75 to 200 tons, fixed base or inclinable. Features and specifications included.

3 TOOLROOM LATHE — *Hardinge Brothers, Inc, Elmira, NY.* 24-page bulletin HLV illustrates and describes 10-in. Model HLV incorporating pushbutton infinite spindle speed control (speeds from 125 to 3000 rpm) and independent variable electric feed for carriage and cross-slide. Operating features, specifications, tooling accessories covered.

4 SURFACE GRINDER — *Thompson Grinder Co, Springfield, Ohio.* 9-page illustrated catalog describes Type CX hydraulic units; table work surfaces from 30x72 to 36x240; table speeds from 10 to 100 fpm. Complete specifications and optional auxiliary equipment included.

5 METAL-CUTTING LATHE — *Delta Power Tool Div, Rockwell Mfg Co, Pittsburgh 8, Pa.* 8-page folder illustrates line of 11-in. units. Ten basic models described, with specifications and standard equipment. Design features and accessories pictured.

6 VERTICAL BENCH MILLING MACHINE—*Elgin Tool Works, Chicago 13, Ill.* 4-page bulletin illustrates design features of Model VM-2. Max distance from spindle to table, 7¾ in.; five speeds ranging, for example, from 600 to 6000 rpm with 1750 rpm motor.

7 PRESS BRAKES & BRAKE DIES —*Service Machine Co, Elizabeth, NJ.* 8-page folder illustrates and gives specifications on SEMCO steel brakes and forged steel dies. Standard dies up to 12 ft available.

8 DRILLING MACHINE—*Ediund Machinery Co, Cortland 2, NY.* 4-page bulletin 160 illustrates. Model 1F, in pedestal and bench type, with from one to six spindles, speed ranges from 625 to 10,000 rpm.

9 POWER PRESS—*Sales Service Machine Tool Co, St Paul 14, Minn.* Bulletin describes Press-Rite No. 45, a 45-ton, open back, inclinable unit with built-in steel tierods and extra-heavy 4-in. crankshaft at main bearings. Lists specifications and extra equipment available.

10 GRINDERS — *Besly-Welles Corp, Grinder Div, Beloit, Wis.* 16-page illustrated catalog 200 describes complete line of double horizontal disk grinders ranging from 3 to 50 hp, using from 12 to 72-in.-dia wheels. Application and construction data, and work feed fixtures included.

11 SLOTTER—*Lobdell United Division, United Engineering & Foundry Co, Wilmington 99, Del.* 4-page bulletin pictures Lobdell Dill unit (mechanical) available in two models, Universal or Standard, 12, 18, and 24-in. stroke. Former has swiveling head for angular surfaces with 15° adjustment either side of center; latter has non-swiveling head.

TOOLS AND ACCESSORIES

12 BROACHES — *American Broach & Machine Co, Ann Arbor, Mich.* 33-page illustrated, revised catalog 450 covers broach design, internal and surface units, broach pullers, keyway broaching, resharpening and maintenance. Second section deals with machines, internal and surface broaching operations, and fixtures.

13 CARBIDE BLANKS, TOOLS, INSERTS—*Vascoloy-Ramet Corp, Waukegan, Ill.* 45-page catalog VR-442 illustrates complete line; technical data on proper grade selection; new standard blank and rectangular strip sizes; triangular, square, and round inserts in throw-away length; prices included.

14 TOOLS—*L S Starrett Co, Athol, Mass.* 464-page 75th anniversary catalog (No. 27) contains illustrated information on complete line of mechanics' hand measuring tools and precision instruments.

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steel tapes and rules, dial indicators and gages, saws, band knives, precision ground die and flat stock. Sectionalized and indexed, it includes operational instructions and applications.

15 CHUCKS—*Horton Chuck Division, E Horton & Son Co, Windsor Locks, Conn.* Combination catalog and net price selector, No. W-200, describes Horton's lathe chuck additions: the 3 and 6-jaw Tru-Set adjustable unit in sizes from 3 to 12 in. (guarantees 0.0002 TIR), and the Windsor Mechanite model, 2 to 12 in.

16 HEIGHT GAGE—*B & J Tool Co, Poughkeepsie, NY.* Illustrated bulletin describes unit which can be converted into small comparator by using a serrated, hardened, lapped anvil. Fast-setting gage can be used with any AGD indicator.

17 AIRCRAFT DRILLS — *Whitman & Barnes, Plymouth, Mich.* Illustrated circular gives specifications and prices of high-speed extension and threaded shank drills for hard-to-reach operations.

18 STEREOMICROSCOPES—*Bausch & Lomb Optical Co, Rochester 2, NY.* 38-page brochure provides illustrated, detailed information on applications of 3-D microscopes for various assembly and inspection operations. Proper unit for specific type of work can be determined by using 10-question automatic model-selector card provided.

19 COMPARATOR CHARTS — *Vanguard Instrument Corp, Valley Stream, NY.* Chart service for optical comparators described, several typical cases given with cost figures to show savings. Also covered are direct-view overlays for casting inspection.

20 UNDERCUT MEASUREMENT GAGE — *Mueller Laboratory, Monrovia, Calif.* 6-page folder pictures and describes instrument with interchangeable tips for measuring O-ring and snap-ring grooves. Measurement range is 0.187 to 2.250. Operating details and specifications included.

HEAT TREATING AND WELDING

21 WELDING PROCESS—*Westinghouse Electric Corp, Pittsburgh 30, Pa.* 7-page booklet B-6525 covers performance and applications of consumable electrode inert gas welding process called West-ingarc. Descriptions of fillet, lap, butt, and plug welds illustrated; table of physical properties given.

22 AUSTEMPERING & MARTEMPERING—*Ajax Electric Co, Philadelphia 32, Pa.* 7-page Technical Bulletin No. 500 on present status covers history of development; basic S-curve theory; reasons for using; selection factors; equipment requirements; recent developments, typical examples.

23 THERMOCOUPLE & PYROMETER SUPPLIES—*Bristol Co, Waterbury 20, Conn.* 56-page bulletin P1238, an illustrated buyer's guide and user's manual, contains engineering data on selection and installation; recommendations for specific applications outlined. Booklet includes accessories available, as well as thermocouple calibration tables based on new NBS Research Paper 2415 and Circular 508.

PLANT SERVICE EQUIPMENT

● LIFTING EQUIPMENT — *Economy Engineering Co, Chicago 54, Ill.* 40-page illustrated catalog 55 describes complete line of materials handling and overhead service machines. Request direct on company letterhead.

24 BLAST-CLEANING MEDIA—*Baldwin-Hill Co, Trenton 2, NJ.* 4-page bulletin describes characteristics and performance of non-metallic, dustless Mono-Kleen mineral shot; non-conductive, non-corrosive material cleans in one pass over surface.

25 PUMP PROBLEMS—*Eco Engineering Co, Newark, NJ.* 4-page bulletin PT includes chart to quickly identify probable source of failure or erratic performance in rotary displacement units. Details 25 possible mechanical and chemical trouble symptons.

26 INDUSTRIAL HOSE—*J N Fauver Co, Detroit 1, Mich.* 24-page catalog 55 of hose assemblies, couplings, stems, swivels, and accessories gives description, specifications, engineering data.

27 SAFETY EQUIPMENT — *Wilson Products, Reading, Pa.* 64-page illustrated general catalog covers eye, head, respiratory protection, and welding. Includes ordering information.

PARTS AND MATERIALS

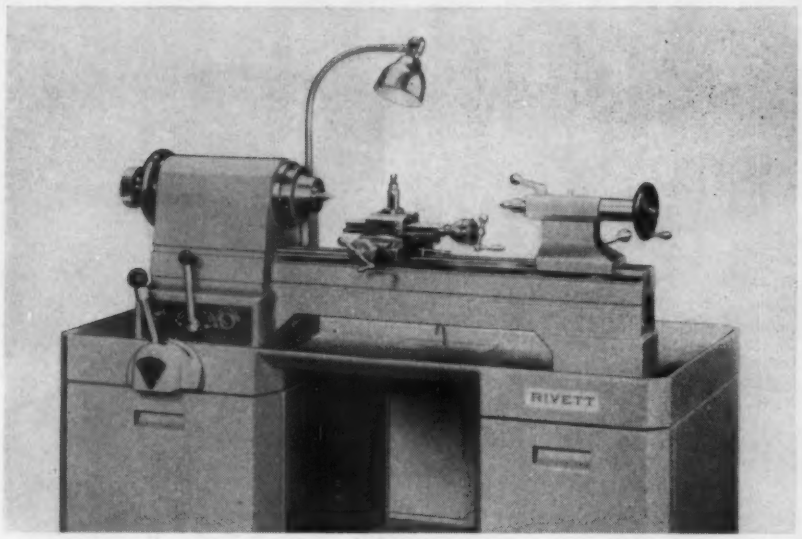
28 ELECTRIC VALVES—*Skinner Electric Valve Division, Skinner Chuck Co, Edgewood Ave, New Britain, Conn.* General catalog on solenoid-operated valves describes five basic types and discusses possible variations. Includes selection data for various applications, and cross-indexed price list.

29 STANDARD ALUMINUM SHAPES *Harvey Aluminum, Torrance, Calif.* 60-page book illustrates and describes shapes available from existing tooling; summarizes advantages of aluminum, explains design benefits of special shape extrusions, enumerates mechanical properties and applications of aluminum alloys, and standard tolerances applicable to average shape.

30 NUTS—*National Machine Products Co, Utica, Mich.* 24-page engineering data section covers manufacturing and installation techniques. Guide chart calculates wrench torques for Standard, 12-Pointer, Marsden, and Huglock nuts; data on all variables to be considered in relation to bolt tightness and wrench torques.

31 AIR CYLINDERS — *Miller Fluid Power Co, Melrose Park, Ill.* 8-page illustrated bulletin A-105K presents design, construction, engineering, mounting, and dimensional data on Miller 200 psi heavy-duty units from 1½ through 14-in. bores in strokes up through 22 ft, and 17 standard mounting styles.

32 GEARING—*Foote Bros Gear & Machine Corp, Chicago 9, Ill.* 30-page illustrated engineering manual DR 2 covers complete line of Duti-Rated Lifetime Gearing. All standard sets listed by center distance and capacity for selection to suit specific applications.



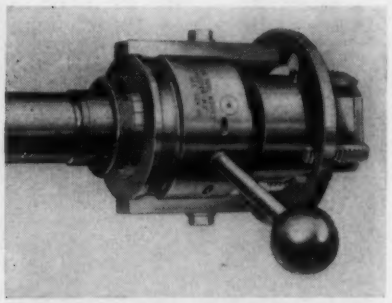
Production or Variable Drive Optional on Cabinet Lathe

Improved 9-in.-swing cabinet lathe, model 918, features the option of a production drive permitting one-operator motion for multiple functions, and variable drive for instant selection of speed from 90 to 3750 rpm.

Workholding methods have been improved and controls grouped for operator efficiency. A lever chuck closer reduces effort; the 1⅛-in.-capacity draw-in collets mount directly in spindle mouth; stationary collets have no in or out motion; step chucks provide accurate holding of circular or irregular parts.

Additional features include: double-bevel steelways; self-aligning slide rest; endless V-belt. The headstock spindle revolves on two super-precision pre-loaded ball bearings and wide spacing of 7¼ in. on ball centers diffuses heat of end-thrust preload and distributes radial load.

Rivett Lathe & Grinder, Inc, Brighton 35, Boston, Mass

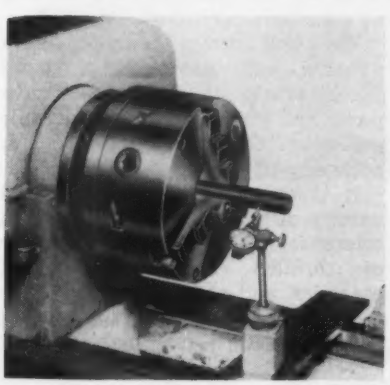


Collapsible Tap

The Type MC collapsible tap made in five sizes ranging from 1 5/16 to 3½ in, has a micrometer adjustment in increments of 0.001 in. Approximately three-fourths of the component parts of all five sizes are identical and interchangeable. Shanks can be detached from tap body and furnished to fit any machine socket.

Float between the shank and body compensates for slight misalignment between the machine spindle and the work. Taps can be used for either stationary or rotary operation. Chasers are all thread-ground and can be furnished in regular or overhanging lengths.

Modern Tool Works, Consolidated Machine Tool Co, Rochester 10, NY



New Horton Chuck Line

The new Horton Tru-Set chuck with guaranteed accuracy of 0.0002 in. TIR, has microscrew adjustment of chuck back which enables lathe operator to align workpiece within limits of accuracy of lathe. Chuck is available with 3 or 6 jaws, and each has three operating pinions for opening and closing the jaws. Each is supplied with two sets of jaws and is available in sizes of 4 to 12 in. in dia. The bodies are fabricated from Meehanite and carry lifetime guarantee against breakage.

Also introduced is the Horton Windsor, available from 4 to 12 in. in dia, with Meehanite bodies, for straight recess and type L and D1 ASN mountings.

Horton Chuck Div, The E Horton & Co, Windsor Locks, Conn

High-Lift Platform Truck

Lift Trucks, Inc has announced the K hydroelectric, hand-motorized high-lift platform truck. The KHW model is manufactured in 2000- and 3000-lb capacity. Mast assembly is telescopic with roller-type construction having lifts of 60, 108, and 120 in. Platform is 7-in. lowered height minimum, 24 and 26 in. wide. Lengths are from 36 to 60 in.

The KHW features the Dyna dual power unit and an articulated frame for strength and greater stability. The power unit and hydraulic assembly have a low current draw to give longer life to the battery.

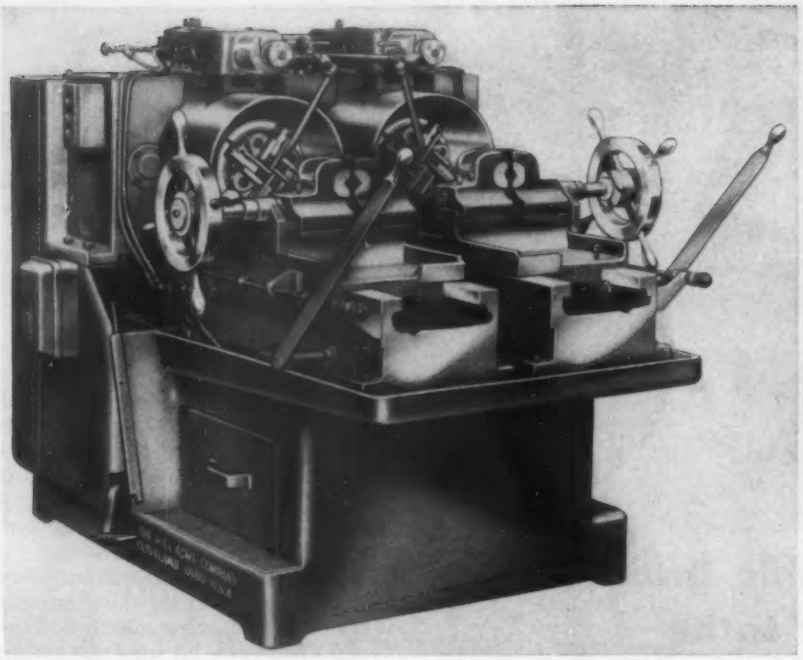
Lift Trucks, Inc, Cincinnati 1¼, Ohio

Sonometer Spots Flaws Near a Surface

The Sonometer differs from echo-principle detectors in that it can spot flaws near a surface and is not affected by beam angles. It has a sonic transmitting head which sends a beam directly through the entire test object to a separate receiver. Soundheads are available for angular viewing on odd-shaped or inaccessible objects. Any irregularity such as microscopic cracks, folds in metal, air bubbles, grain variations, or gross impurities effects a response indicating a flaw.

Items reported to have been successfully tested on a mass production basis are: thin metal foil, sheets up to 30 in. thick, watch springs, bimetal plates, wire, engine cylinder rolls, etc.

Curtiss-Wright Corp, Wood-Ridge, NJ



Hill Acme Threading Machine Meets Varied Requirements

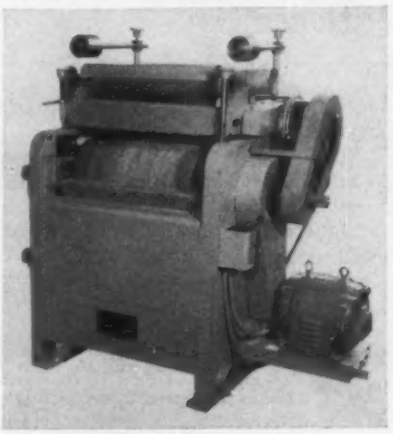
Model XLA is designed to meet requirements expected of plant maintenance machine as well as accurate production work. It can be adapted for threading bolts and studs, as well as hollow milling and pointing. Design is single or double spindle in 1, 1½, 2, or 2½-in. capacity.

Carriages are lever-operated and shimmed to provide wear compensation. An adjustable trip-rod is attached which automatically opens the die head. The constant-speed motor is mounted on a hinged base in the bed. V-belt drive to four-step sheave offers spindle speeds for threading all diameters within machine range. Speed changes are made by depressing pedal to lock stage. Double-spindle machines are equipped with separate motor and starter for each spindle. Starting, stopping, jogging, and direction of rotation are electrically controlled by pushbutton station.

Model LLH die heads are standard equipment. The revolving die head is opened and closed by a machine yoke, which in turn is operated by a valve and air cylinder. Die head is tripped open automatically at the end of each cut by the forward movement of the carriage. There is a micrometer adjustment for controlling thread diameter while head is in motion. Both tangential and radial chasers can be used.

The machine bed is equipped with hardened and ground ways. Coolant reservoir is covered by a screen and removable chip drawer for rapid coolant return. The ground spindle is bored to allow the threaded stock to pass through it, so by re-gripping the work, unlimited thread lengths are possible.

The Hill Acme Co, Acme Machinery Div, 1209 W 65th St, Cleveland 2, Ohio



Polishing, Deburring Machine Equipped with Automatic Feed

Smooth-O-Matic feed machine for polishing and deburring metal handles all types of flat stock and metal sheets, single plane curved metal surfaces, and modified shaped and tapered metal pieces.

Work is fed over the abrasive belt at a high rate of speed; unit, reportedly low in cost, finishes aluminum, stainless, copper, and other metals.

Timesavers, Inc, Minneapolis 22, Minn

Ultrasonic Drill Handles Hard Metals and Ceramics

The Diatron consists of an electronic unit capable of developing 500 watts of sonic energy at the cutting tool. The abrasive is accelerated by a water-cooled magnetostrictive unit vibrating 25,000 times a second. A centrifugal pump circulates water-abrasive fluid around the cutting edge.

No outside boring pressure is required. The weight of a magnetostrictive head creates proper boring pressure. Abrasives such as silicon carbide or boron carbide can be used. Graphs are available to aid in machining of resonant drills, or preformed drills tapered to any end diameter between ⅛ and 1 in. will be supplied on request.

The unit comes complete with pedestal and moving bed, depth gage, magnetostrictive head, abrasive pump and accessories, and electronic generator. Conical drill blanks are accessory items.

It is reported that an unlimited variety of shapes may be drilled to tolerances of 0.0001 in. on all kinds of carbides, sintered materials, ceramics, and steels.

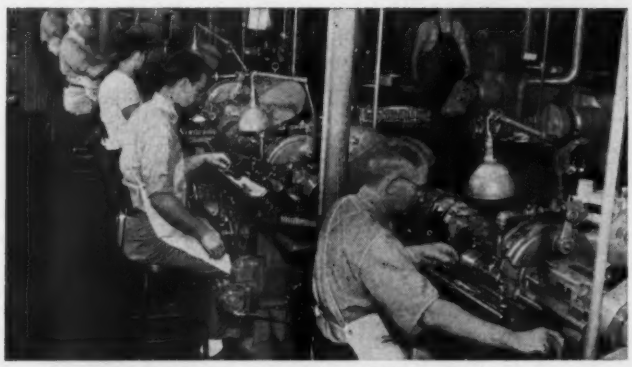
Curtiss-Wright Corp, Industrial & Scientific Products Div, Caldwell, NJ

Air Press

Model 80, 1-ton capacity, develops power up to 15 times air-line pressure. Ram head is adjustable to two positions; position of threaded ram plunger is adjustable up to 2½ in. Operating line pressure ranges from 5 to 150 lb; ram clearance from 0 to 5 in. with a ⅝-in. stroke; throat clearance to center of 10-in. circle, base over-all, 5½ in. wide, 13½ in. long; price $85.

W R Brown Corp, 2701 N Normandy Ave, Chicago, Ill

TAP PRODUCTION IS HY-PRO'S SPECIALTY



HY-PRO SPECIALIZES tap making within every department —from design through all manufacturing operations— to insure the highest-quality product for you.

THE HIGH DEGREE OF AUTOMATIC OPERATION in Hy-Pro's production lines means the prompt delivery of your order, while maintaining tolerances down as low as .0001 in.

. . . it can help cut man-hours from your operation

Tap production is specialized at Hy-Pro. The full staff concentrates their work on this one important line. Every operation in the manufacture of Hy-Pro taps is constantly restudied and re-evaluated to bring you the finest quality product at a minimum cost.

It is this dependable record through the years which has won Hy-Pro their reputation as *"The Tap Specialists"*.

It will pay you to get in touch with your Hy-Pro distributor or to call Hy-Pro direct. They offer you a full line of highest-quality taps, backed by the experience of specialized production.

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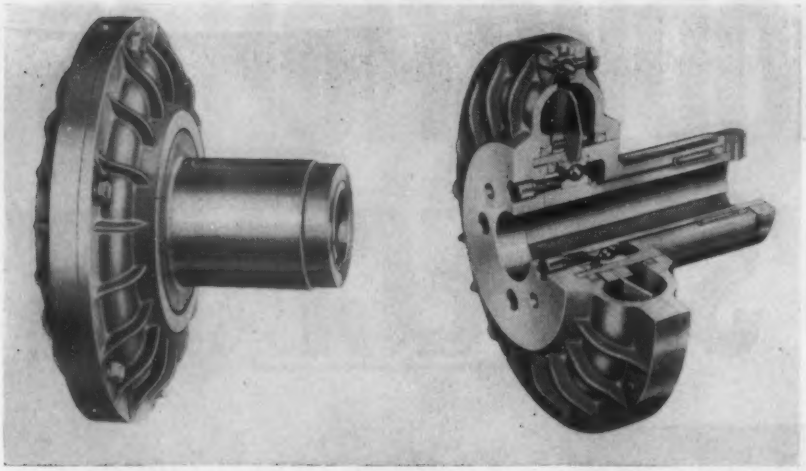


Industrial Power Transmission Termed "Dry" Fluid Drive

Flexidyne drive is made up of a housing inside of which is a rotor free to turn concentrically. Between the two are fine particles of spherical steel shot, called the flow charge, which transmit power. The charge is easy to seal in, has a high density, and can stand relatively high temperatures.

Operating principle is as follows: Motor is connected to housing, starts it turning at no load; flow charge is thrown out, compressed by centrifugal force, and revolves with the housing; rotor is accelerated by friction and wedging action of revolving flow charge.

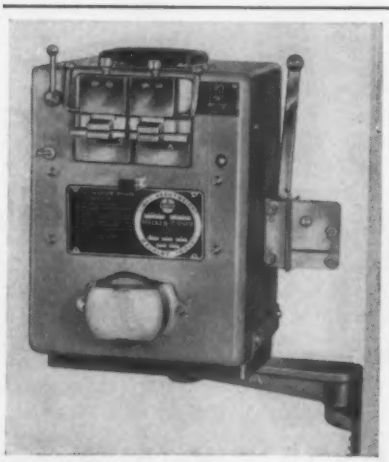
The Flexidyne operates with zero slippage between motor and load—in case of overload, rotor slips relative to housing, overcoming friction and wedging action of charge.

As optional equipment, a thermal switch automatically breaks electrical circuit if overload persists.

The amount of flow charge determines the torque capacity. It is easy to vary the amount, thus the Flexidyne will give exact starting torque needed. Accurate overload protection is assured because drive can be set to slip from a low of 20% over full load torque to as high as peak motor torque. The Flexidyne produces constant torque for given input speed, regardless of percentage of slip.

Two lines will be available: (1) Drives for mounting directly on motor shafts and adapted for Dodge Taper-Lock Sheaves; (2) Couplings with Taper-Lock bushings for straight-line drives. First to be offered will be four sizes, rated at 3 to 30 hp at 1800 rpm. Additional sizes will follow at regular intervals.

Dodge Manufacturing Corp, Mishawaka, Ind



Bandsaw Blade Welder

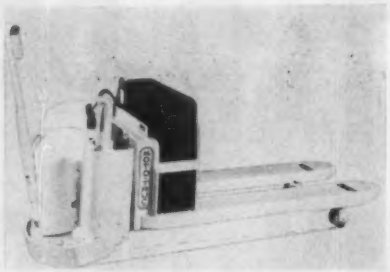
The average time for butt-welding a bandsaw blade is less than 2 min with this ¾-in.-capacity light-heavy-weight bandsaw welder. Features include quick, easy-operating, adjustable, heavy-duty blade clamps with cam locks and built-in flash grinder. The manufacturer claims the transformer and relay components are of exceptional quality. The 115-v model illustrated includes a cutoff shear and lists at $189.50. A 230-v model is also available.

Walker-Turner Div, Kearney & Trecker Corp, Plainfield, NJ

Gage Line

Precision gages added to the Card line of taps, dies, and screw plates, include reversible thread plug, plain cylindrical plug, reversible wire type plug, taperlock thread plug, thread ring, and plain cylindrical ring.

S W Card Manufacturing Co, Div, Union Twist Drill Co, Mansfield, Mass



Pallet Truck Available With Jack Knife Clearance Action

Moto-Truc has added a pallet model to its line of trucks incorporating "Jack Knife" action which raises truck frame to provide sufficient clearance over uneven floors or sharply rising ramps.

Dotted line in illustration shows clearance angle on conventional unit, solid line illustrates new clearance which eliminates hang up and increases operational range. Action, accomplished by hydraulic pump and ram unit, is optional.

Moto-Truc Co, 1974 E 59th St, Cleveland 3, Ohio

Small Curved Parts Gaged and Sorted

A semi-automatic electronic sorting gage for measuring small curved parts and sorting them into several dimensional categories, Model 144 B-53 measures the chordal height of the curvature on thermostatic diaphragms and sorts them into six good categories, plus oversize and undersize. Speed of hand-fed, timer-controlled gage, 2500 pieces per hour.

To operate gage the operator first places work over retracted reference anvil and foot pedal is then pressed to start cycle. Reference anvil moves up to support workpiece beneath sensitive gaging contact—part of electronic gage head. Classifier causes trap door to open and after reference anvil retracts, operator slides part into correct disposal chute.

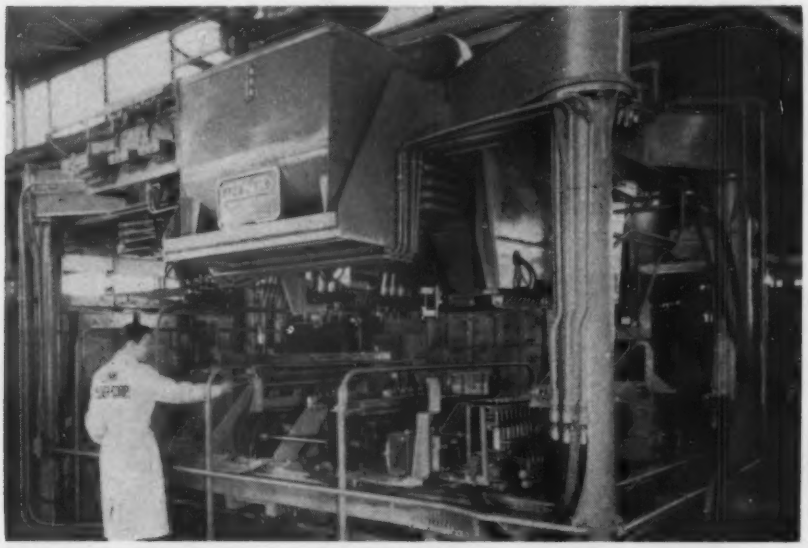
Federal Products Corp, 1144 Eddy St, Providence 1, RI

Quality Speaks

among the thousands of users of

The only manufacturer of a complete range of heavy duty and light duty surface and contour grinders

THE THOMPSON GRINDER COMPANY, SPRINGFIELD, OHIO



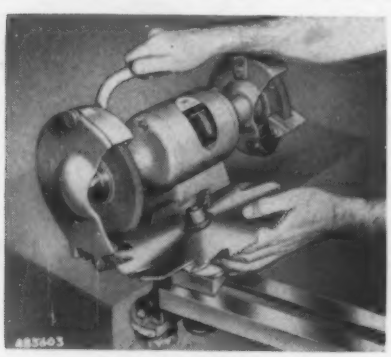
Link Resistance Welding Press Adapts to Variety of Industries

Resistance welding press is reported adaptable to a variety of complete tooling changes to meet specific metal fabricating requirements. The four-post mechanical welding press will accept any welding fixture necessary and is engineered for quick, simple removal of multiple-point fixture.

The first series of machines are now fabricating complete floor panel assemblies for an automobile manufacturer. The underbody differs completely from model to model. Turning a switch causes the fixture to adjust itself. In this process, the fixture is automatically indexed from left to right and vice-versa so each gun welds two spots on each piece. Designed to weld dash panel to front floor panel to rear panel, machine produces 120 assemblies per hour.

Hydraulically operated, press is equipped with air surge tank. Specifications include: max platen size, 80x160 in.; platen height in down position, 30 in.; stroke, 18 in.; shut height, 5 in.; and speed of 15 spm.

Link Welder Corp, 13684 W Buena Vista, Detroit 27, Mich



Circular Saw Grinder

Model 3140 Foley grinder provides for sharpening all types of circular saws—rip, crosscut, or combination toothed, from 5 to 44 in. in dia. Positive settings provide correct pitch on all teeth as well as uniform tooth height, depth, and bevel. Saw tilts to 45° both ways for bevel grinding.

Pointer and graduated quadrant scales reportedly insure quick and accurate positioning. Firmly anchored saw support insures grinding accuracy and prevents vibration. The grinder meets all safety standards including emery wheel guards. High speed 1/3-hp motor has lifetime-lubricated ball bearings. Complete unit, including motor, is priced under $100.

Foley Manufacturing Co, Dept 38, Minneapolis 18, Minn

New Titanium Alloys

Mallory - Sharon has announced quantity production of two titanium alloys.

One, the 6 Aluminum - 4 Vanadium (MST 6Al-4V), the first weldable titanium alloy having high notch toughness, has properties comparable to those of high-strength steels used in armour plate and weapons. It reportedly has excellent thermal stability, and can be used at temperatures up to 750 F with maximum creep resistance.

The second, 3 Manganese Complex (MST 3Mn Complex), is a heat-treatable material whose properties can be varied predictably by treatment. Designed for use up to about 500 F, the alloy is expected to have many applications where a lightweight replacement for high-strength steel is required.

Mallory-Sharon Titanium Corp, Niles, Ohio

Maneuverable Towmotor Handles Loads up to 2½ Tons

Model 500 and 500-D fork lift truck is a 5000-lb capacity unit reported to be highly maneuverable.

Available in both gasoline and Diesel powered models, truck has an 81-in. turning radius, and can be operated in aisles 69 in. wide.

Towmotor Corp, 1226 E 152nd St, Cleveland 10, Ohio

Collet Adapter Trues Work

Economy 5C face plate collet adapter is designed for application with new or old equipment to true work with absolute accuracy, and to enable rapid setups for turning eccentrics.

Permits standardization on 5C collets, precise offset setups for milling machines as well as lathes, and a bigger range of collet sizes without need to rebore spindles. Unit runs independent to the spindle, and can be indicated to any position, including dead true, regardless of error in collet itself. Available in capacities up to 1 in.

Eco Engineering Co, 12 New York Ave, Newark 1, NJ

SIMONDS ABRASIVE CO.

snagging wheels

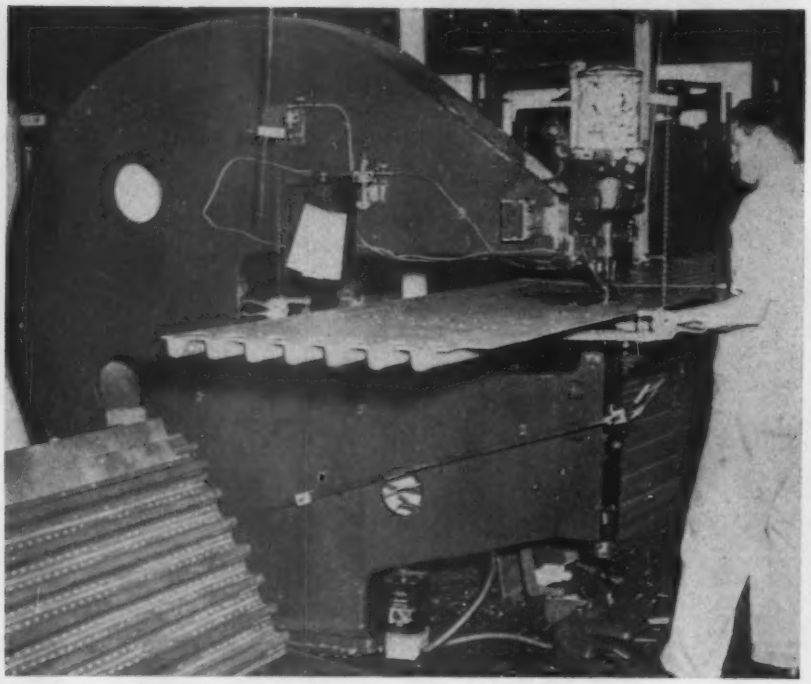
for extra safety

with Patented Reinforcing Flanges...

Rugged, high speed resinoid bonded wheels . . . strong enough to take more than double the force usually encountered in grinding under normal conditions of use. Simonds Reinforcing Flanges prevent radial cracks as wheel wears down to stub. Available in wheels of 6″, 10″ and 12″ hole sizes. Send for bulletin ESA 154 "Simonds Red Streak Flanges" and name of your distributor.

SIMONDS ABRASIVE COMPANY • PHILADELPHIA 37, PA.

Branch Warehouses: Boston, Detroit, Chicago, Portland, San Francisco • Distributors in Principal Cities
Division of Simonds Saw and Steel Co., Fitchburg, Mass. • Other Simonds Companies: Simonds Steel Mills, Lockport, N.Y., Simonds Canada Saw Co., Ltd., Montreal, Quebec and Simonds Canada Abrasive Co., Ltd., Arvida, Quebec



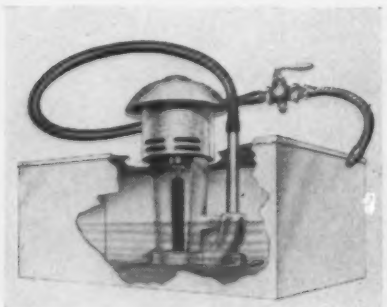
Punching and Riveting Machines In New Electrified Models

All ACF 18-, 36-, and 48-in.-throat automatic punching and riveting machines are now manufactured in new electrified models with rivet-diameter capacities up to ¼ in. In one operation machines can punch, or punch and press-dimple holes for flush head rivets, and automatically feed and head rivets.

Electrically activated and interlocked, the machines feature pneumatic shift with hydraulic snubbing action for speed control, air stripper, air-driven hopper drum, and built-in electric safety control.

Standard machines are arranged for two-cycle operation, but arrangement for single cycle is available as optional feature. With 90 to 100 psi on the driving plunger, machine can obtain speeds to 45 rivets per minute.

Engineering and Research, ACF Industries, Inc, 30 Church St, New York 8

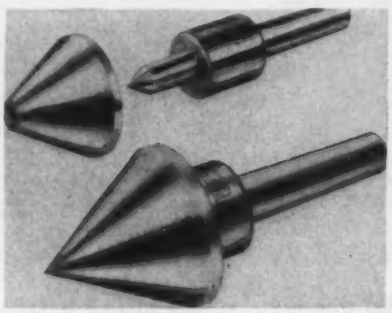


High Volume Coolant Pump

Model 400 pumps coolants, cutting oils, water solvents, and other light liquids to grinders, mills, upright drills, cutoff machines, and others requiring coolant in volume. It can also be used for liquid abrasive applications, such as glass polishing and grinding.

Unit, which pumps up to 720 gph at 0.87 pressure psi, is available with or without tank. Two tank sizes are available, at extra cost, 6 gal. and 12 gal.

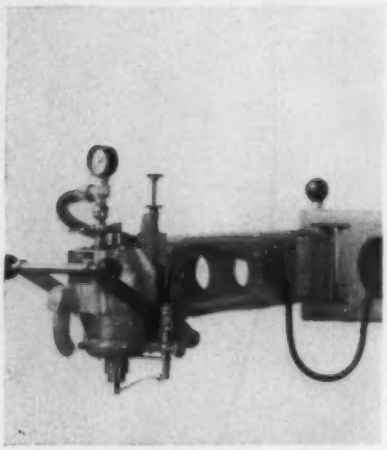
Junior Tool Co, 975 W First St, Azusa, Calif



Live Centers Are Dual Purpose Units

Center has a removable pipe head which can be detached with light tap to make conventional center. Pipe head is deeply countersunk for low overhang. Except for a longer spindle projection this is the same construction as the regular Motor Tool live center line with heavy-duty radial roller bearing (28 in. of line bearing contact in the No. 4 Morse taper size); heavy-duty ball thrust bearing; long-wearing needle bearings, alloy steel housing, case hardened on outside only for long wear and toughness; tough high-carbon high-chrome spindle; and tempered steel springs to compensate for elongation of work through heating. The grease seal retains lubrication and keeps out dirt and chips. Centers are available for Morse tapers No. 3 and No. 4.

Motor Tool Mfg Co, Box 3805, Detroit 5, Mich



Radial Arm Bench Router

Model W-106A, capable of 30,000 rpm, is designed for edge trimming and cut-out operations on plywood, plastic, and aluminum alloy sheets.

Maximum reach of arm is to any point on a table in a radius of 44 in. from center of column. Unit is available with pneumatic motors: 1 hp at 22,000 rpm, and ¾ hp at 30,000 rpm. Model illustrated is equipped with a Norgren lubrication tank, hose and fittings. The 200-lb unit is normally mounted directly to table or bench top.

Onsrud Machine Works, 3900-32 W Palmer St, Chicago 47, Ill

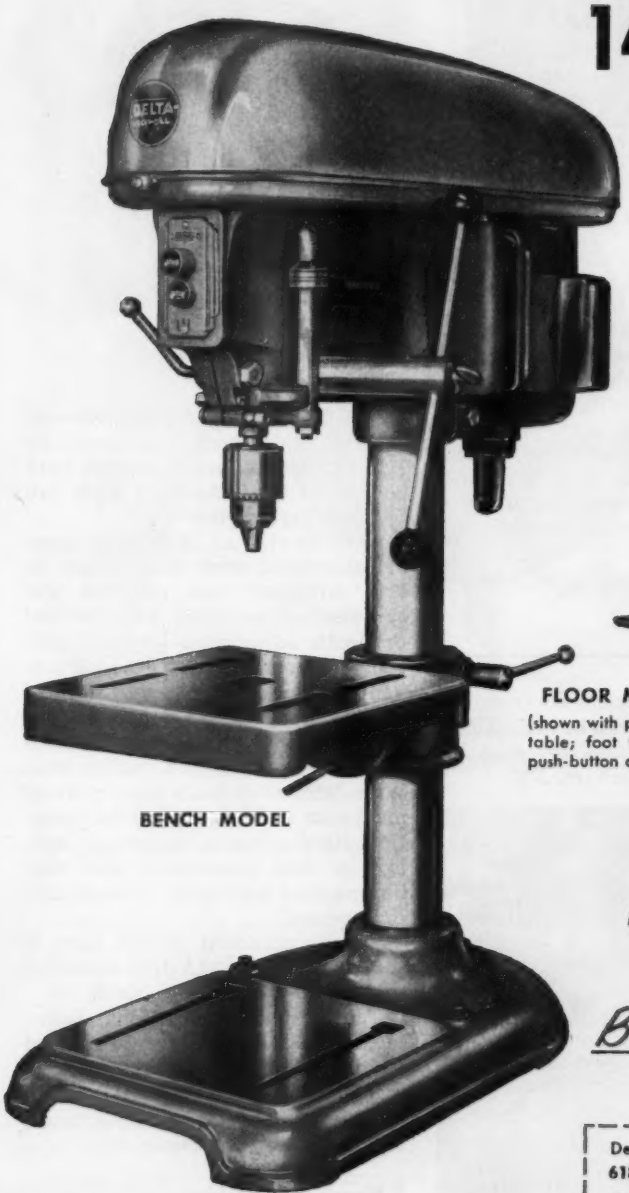
Die Cushion

Pneumatic die cushion, Model HC-22-9, extra-heavy, all-steel, for double crank power presses, carries a wall thickness of 1⅛ in. with an overlap of about 36 in. On a 100-lb airline, it develops 38-ton ring holding pressure. Equipment has a drawing stroke capacity of 10 in., and is designed to compensate for a minimum amount of off-center loading.

Dayton Rogers Manufacturing Co, Minneapolis 7, Minn

At No Increase In Price...

A Completely New Line of DELTA 14" Drill Presses



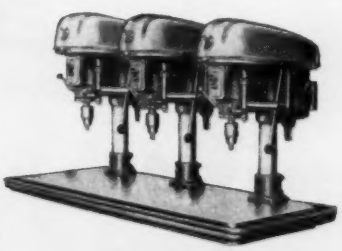
BENCH MODEL

FLOOR MODEL
(shown with production table; foot feed and push-button control)

SEE THEM NOW!

A ten-minute demonstration will tell you more than ten thousand words about the great new DELTA 14" Drill Press line! See for yourself how eleven exciting new features increase accuracy and speed, decrease operator fatigue. See how the *low* Delta price gives you the biggest drill press value in history!

Let your Delta Dealer demonstrate the great new line of Delta 14" Drill Presses *now!* He's listed in the classified pages of your phone book under "TOOLS" or "MACHINERY."



MULTIPLE SPINDLE MODEL
(from 2 to 200 heads)

DELTA QUALITY POWER TOOLS
Another Product by **Rockwell**

DELTA ROCKWELL

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DELTA QUALITY COSTS NO MORE

Be Sure to Send this Coupon for Full Catalog Data—

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☐ Please send catalog on new Delta 14" Drill Press line.

☐ Please send name of my nearest Delta Dealer who has the new 14" Drill Press on display.

Name_____ Title_____

Company_____

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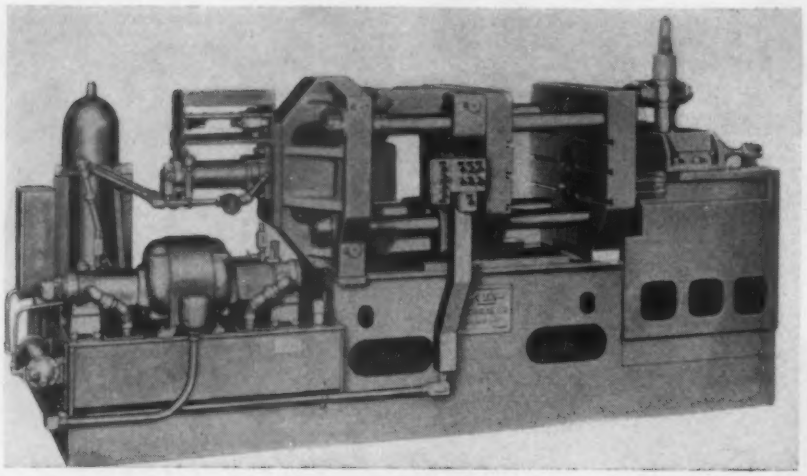


Kux Die-Casting Machine Has Improved Design

Model BH-30 die-casting machine—plunger gooseneck type for the production of zinc, lead, or tin die castings—has been increased in weight to 24,000 lb through use of 6-in.-thick solid steel die plates, 4-in.-dia tie bars, and a channel steel base, extending entire length of machine.

Rated die-clamping pressure is 400 tons. Die space between tie bars is 32½x17¾ in. The new hydraulic system provides fast cycle through use of two single-stage pumps mounted to 15-hp double-end motor. Operating speed is ten cycles per minute.

Fully automatic, machine is capable of injecting up to 25 lb of zinc, applying injection pressures of up to 2000 psi with injection speeds of up to 400 fpm.

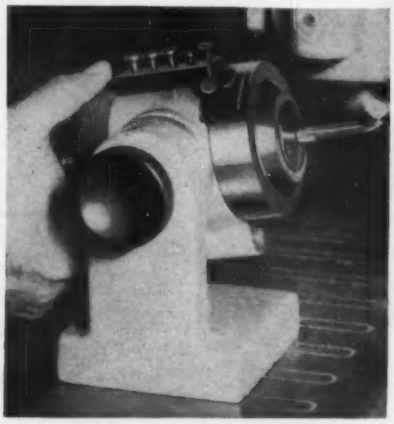
Kux Machine Co, 3924 W Harrison St, Chicago 24, Ill

Ultrasonic Drill

Mullard 50-w ultrasonic drill produces a vertical reciprocating action to make holes of any shape and complexity in hard and brittle materials such as glass, ceramics, germanium, tungsten, titanium carbide, and diamonds.

All normal machining operations —drilling, shaping, grinding, and polishing can be performed. Reciprocating action is used with an abrasive slurry; surface finishes of 18 to 20 mu-in. are attained, depending upon coarseness of abrasive used. With a 120-mesh abrasive, accuracy of 0.003 in. can be maintained.

International Electronics Corp, 81 Spring St, New York 12, NY

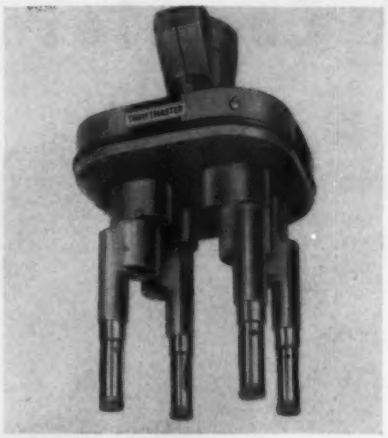


Portable Tap Sharpener

The Rocket re-sharpens either RH or LH taps of two, three, or four flutes in three minutes, according to the manufacturer. It can be used on any make or any size grinder with a magnetic chuck.

Unit is equipped with one ½-in. collet, and will accommodate any standard 5-C collet of ⅛ to 1-in. capacity. First liner sleeve is off center to cut radial clearance on tap; second is on dead center for indexing purposes. Shipping weight of the 6x6x7-in. model is 18 lb.

Rockford Die & Tool Works, 1816 Seventeenth Ave, Rockford, Ill



Adjustable Drillhead Is Double-Eccentric

A full ball-bearing double-eccentric adjustable drillhead announced by Thriftmaster is said to be the only one of its type standard with full ball-bearing construction.

Spindles of head have large range of adjustment and may be set to drill irregular hole patterns. All spindles are provided with vertical or depth adjustment and are held rigid by clamping device which prevents damage to head. Greater rigidity and accuracy during drilling are said to be inherent as there is no offset unsupported thrust load. Wide-faced stub-tooth gears provide maximum strength and quiet operation. Head is sealed against oil leakage or dust penetration and may be operated vertically, horizontally, or inverted.

Twenty standard models have 3, 4, 6, or 8 spindles and drill capacities to 1/16-in.-dia holes in steel.

Can be used for drilling, reaming, tapping, or boring and arranged to fit any conventional drilling machine.

Thriftmaster Products Corp, 1016A North Plum St, Lancaster, Pa

5-Range Arc Welder

Arc welder, 300-amp dc selenium rectifier type, has 5-range control switch to provide coarse adjustment with generous overlap between ranges to provide dual control. Rheostat, removable for remote control, provides welding current range of 35 to 425 amp for use with a variety of electrode sizes.

Hobart Brothers Co, Hobart Square, Troy, Ohio

When you're offered oils "just as good" as Gargoyle D.T.E., remember these facts...

Have you ever wondered why, so very often, you're urged to buy an oil that's "just as good as Gargoyle D.T.E."? The reason is simple...Industry has always accepted Gargoyle D.T.E. hydraulic oils as the *standard of quality* in this field!

These substitutes may have *some* of Gargoyle D.T.E.'s properties—but *none* measures up in all-round performance! Gargoyle D.T.E. hydraulic oils last longer—have given excellent service, in many cases, for thousands of hours! They boost machine efficiency—improve production and quality—help reduce manufacturing costs. That's why—although Gargoyle D.T.E. costs a trifle more (often as little as *one mill* per machine per hour) they actually save you money in the long run!

And here's an *extra* plus . . . the world's greatest lubrication engineering service goes with these famous oils—*at no extra cost!* So why settle for less than the best? Call us today!

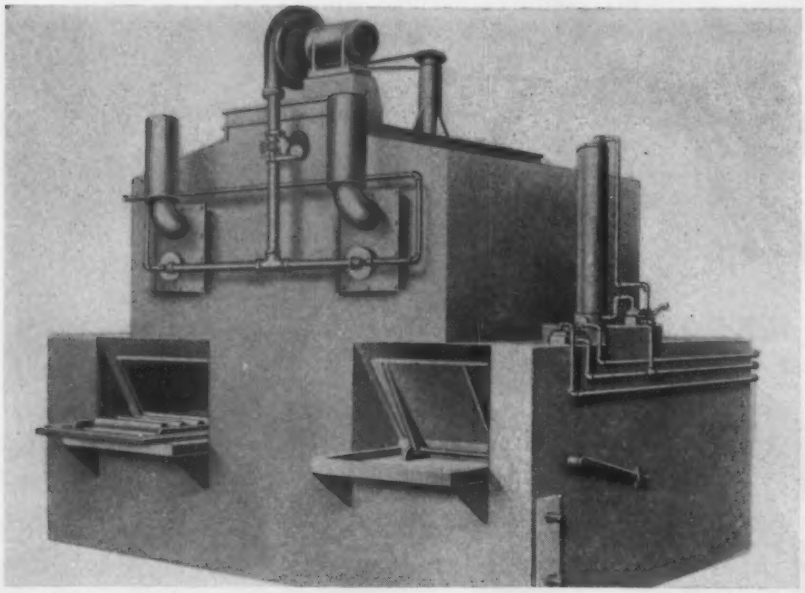
SOCONY-VACUUM

Socony-Vacuum

Correct Lubrication

FIRST STEP IN CUTTING COSTS

SOCONY-VACUUM OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION

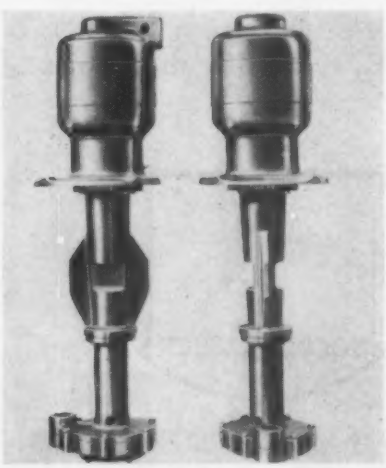


Controlled-Atmosphere Heat-Treating By Bantam-Sized Batch Furnace

Bantam-sized batch furnace for controlled-atmosphere heat-treating can run such typical cycles as: normalizing; carburizing; clean, neutral bright hardening; annealing; tempering; and non-ferrous heat-treating. Furnace has capacity to heat 500 lb gross per hour to 1500 F. It can be operated at temperatures ranging from 400 F to 1800 F.

Only two valves are involved in actual operation. When stock has completed time in furnace chamber, it is lowered by elevator, transferred into position for quenching, and lowered into quench oil. Simultaneously a previously loaded tray of cold work moves onto charge elevator and then into furnace chamber. The furnace requires less than 63 sq ft of floor space. No pits are needed for the installation.

Holcroft and Co, 6545 Epworth Blvd, Detroit 10, Mich



Ruthman Gusher Pump

Model TL-15025K gusher pump, arranged for center-coolant trough mounting on traveling-base machine tool installations, has tapered tubular housing provided with reinforced narrow section for passage through limited-width slot in trough cover. Pump is equipped with one-piece electronically balanced shaft assembly which rotates on two heavy-duty precision ball bearings, one located within top motor and ball housing, another in tubular portion of bracket flange housing.

The unit has no packing glands nor metal-to-metal contacts below the liquid high-level line. The built-in electric motor is available in ½, ¾, and 1 hp.

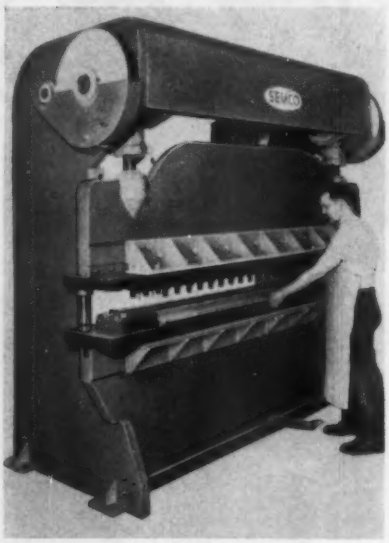
The Ruthman Machinery Co, Cincinnati 2, Ohio

Air-Clamp Cylinder Line

Mead Specialties has introduced a 26-model line of single-acting Air-Clamp cylinders, available in many variations of bore, stroke, and mounting.

Re-design and improvements include: greatly increased bearing surfaces (without lengthening units) to make ram steadier for accurate work; larger diameter return springs to assure longer life and more uniform tension; Oilite ram bearings; surfaces (where required) now machined. Bulletin AC-4.

Mead Specialties Co, 4114 N Knox Ave, Chicago 41, Ill



Press Brakes Feature Ease of Operation

New 55 Series press brakes are designated as Models 55-609 with 6-ft bed-bending capacity 9 gage; 55-811 with 8-ft bed-bending capacity 11 gage; 55-1012 with 10-ft bed-bending capacity 12 gage. Construction features are reported simple and functional. The frame as well as the ram and lower bed are of heavy steel welded construction. The rugged Pitman screws, ball-type with buttress threads, are alloy steel forgings. Eccentric shafts are heat-treated alloy steel forgings. Anti-friction and bronze bearings are used throughout.

The brake and clutch are of the disk type and the brake has a lining simple to adjust, replaced without dismantling entire unit. The presses are double-geared and twin-driven for balanced distribution of power with longer gibs to prevent tilting of the ram when short dies are used. Standard equipment on all models includes 5-hp motor, plus a high-torque motorized ram adjustment, 3-in. stroke, 5-in. ram adjustment, 9½-in. depth of throat, and 14-in. shut height. Optional equipment and features include angle supports for bed and ram; bed and ram of press machined for wide angle supports; micrometer screw adjustment; micrometer front-operating back gages; centralized oiling system; variable speed drive, 20 to 50 spm; and tonnage indicator.

Service Machine Co, Inc, 226 Miller St, Elizabeth, NJ

REVERE

COPPER EXTRUDED SHAPE

SAVES

26% FOR TOCCO

Here is a "fishtail" and the Revere Copper Shape from which it is made. The part is a terminal block on a high frequency transformer, used in induction heating apparatus made by the Tocco Division of the Ohio Crankshaft Co., Cleveland, Ohio. Tocco is an important supplier of induction heating equipment to industry, which uses it for such diverse jobs as heat-treating and hardening, brazing, soldering, removal of gases from metal parts of vacuum tubes, vacuum casting, and heating before forging, upsetting, or other hot working.

The "fishtail" formerly was machined from solid copper bar, and on a typical run, the total cost for a certain number of pieces was $35,000. Revere studied the part with Tocco, and suggested that a shape would save money, even though the plain bar cost 10 cents less per pound. Actual experience produced these figures: total cost on the same number of fishtails, $25,700, a saving of $9,300, or 26.6%.

If your shop is machining plain rod or bar, it might pay you to consider the advantages of extruded shapes. Revere produces them in copper and its alloys, and aluminum alloys. Many design details can be preformed for you, provided they are parallel to the axis of extrusion. Revere would be glad to collaborate with you and see if shapes cannot save you money. See the nearest Revere Sales Office.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

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Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. —Sales Offices in Principal Cities, Distributors Everywhere

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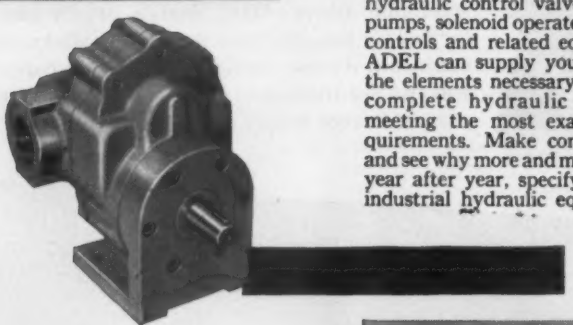
For fourteen years ADEL has continuously directed its energies to the advanced development and production of high-quality hydraulic equipment. With the most modern facilities in our 150,000 square foot plant, we build ruggedness, efficiency and compactness into each ADEL unit. The variety of equipment being manufactured has been steadily expanded until today it encompasses a complete line of hydraulic control valves, power pumps, solenoid operated remote controls and related equipment. ADEL can supply you with all the elements necessary to build complete hydraulic systems meeting the most exacting requirements. Make comparisons and see why more and more users, year after year, specify ADEL industrial hydraulic equipment.



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ADEL DIVISION
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TRI-STATE SUPPLY COMPANY, BROOKLYN 33, N. Y.

ROUND TABLE *Discussion*

BUMS' RUSH

Is it normal to expect the shop men to give a new engineer a hard time, particularly if he's pulled a few boners in the beginning? Can a foreman do anything to prevent it, or should he let the new man take care of himself?

IT MUST BE UNDERSTOOD that when a man takes on a new job he is entirely ignorant of the petty details around the plant. He may be well up on the fundamentals of engineering work—the math, sciences, and whatnot—but in order that he become acquainted with the new work he should receive the cooperation and assistance of the men around him.

His fellow-workers, out of a sense of decency, should put themselves out in order to get the man started but, unfortunately, this is just too much for some of the old gang to do. Those who are the first to raise a howl about the cut-throat methods used in our free enterprise system of business are also first to strangle the opportunities of a new man who enters the plant. Could it be that the new man will show them up plenty after he gets going—that he could display superior knowledge and formulate means of accomplishing greater savings in the cost of production?

Recently I was having a chat with an engineer who was well versed in tools and machinery for production, and he told me what a hard time he had getting started in a certain plant. Eventually everything got to going along smoothly, then for some reason or other the head office saw fit to shift an almost-new crew from one of its other plants to this one. Here was a case of an "old" engineer having to buck the new workers who,

Smooth, even finishes are easier with Heller Spiral-Cut Half Round Files. Ordinary half round files require a skillful twisting. Heller engineering has removed this human element from good file performance. The necessary rolling action is designed right into the Heller Spiral-Cut Half Round File. This new cutting principal is typical of Heller's continuous search for better files. By constantly testing, inspecting, improving . . . Heller guarantees file users "the best."

HELLER BROTHERS SINCE 1836

A NEW JERSEY CORP.

VIXEN *American-Swiss* NUCUT
FAMOUS BRANDS MADE ONLY BY

HELLER BROTHERS COMPANY

America's Oldest File Manufacturer
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BRANCH OFFICES ... New York Chicago Detroit

YOUR HELLER DISTRIBUTOR CAN SUPPLY ALL YOUR FILE NEEDS

HYDRAULIC MARKING MACHINES by Parker

UNSURPASSED FOR EVERY PRODUCTION MARKING APPLICATION

AFFORD FASTER, BETTER, MORE ECONOMICAL MARKING OF ANY LEGEND . . . ON ANY MATERIAL . . . AND EVERY CONTOUR!

No. 650 PARKER MARKING MACHINE

Parker Marking Machines are unmatched for versatility—stamp lettering, trademarks, graduations, knurling in limitless varieties on flat, irregular or curved surfaces of different diameters. Each impression is clean and sharp—indelibly stamped to uniform depth—in far less time, to far greater precision than the finest hand marking.

PARKER CAN PRODUCE A TOOL TO SPECIFICATIONS FOR ANY MARKING MACHINE!

Interchangeable type holders . . . roll dies . . . flat dies . . . engraved knurls—whatever your requirements, Parker engineers and craftsmen can produce a marking tool to your specifications to fit any marking machine.

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as a clique, were out to get him. He told me how they made his stay there just a living hell until his grim fortitude wore down their opposition. If, when he did make a mistake or wrong move, no matter how trivial, word was passed around among the conspirators like a searing fire roaring over a plain of dried-out grass. However, when any one of them gooped on the job it was quietly smothered for lack of activating oxygen.

It is only natural for the fellows to feel serious about the value of a new man of such importance inasmuch as the progress of production affects the bonus at the end of the year. The greatest trouble is the ganging up of the men in opposition to an untried man. The chances are that a man hired to take over a position of responsibility has been given a thorough going-over by the proper authorities before he was hired and it certainly is no business of the men, who have their own work to look out for. But then, we cannot rid ourselves of the suspicious rats who look with disfavor on anyone who enters their cherished domain.

George M Peters
Germantown, Pa

•

MEN GANG UP in the shop. Troublemakers plan to embarass a fellowworker. This is evidence of a lack of discipline, of a lack of leadership on the part of management.

Such a condition takes a long time to build up. Some members of management have followed the line of least resistance. They have sacrificed pride, honor, courage, dignity, manliness, in a pragmatic desire to get along with the "boys."

The "bums' rush" situation is a sorry predicament, yet it is not an uncommon one. Strict discipline is needed to bring the situation under

"I can't help feeling somebody in methods made a mistake."

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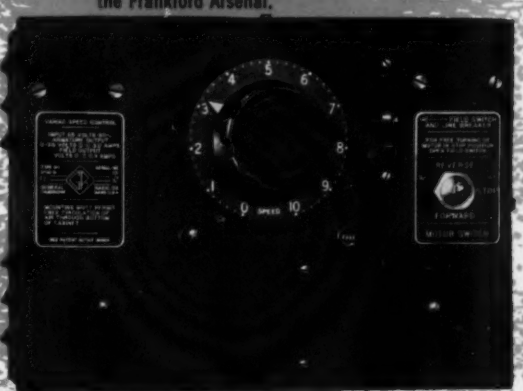

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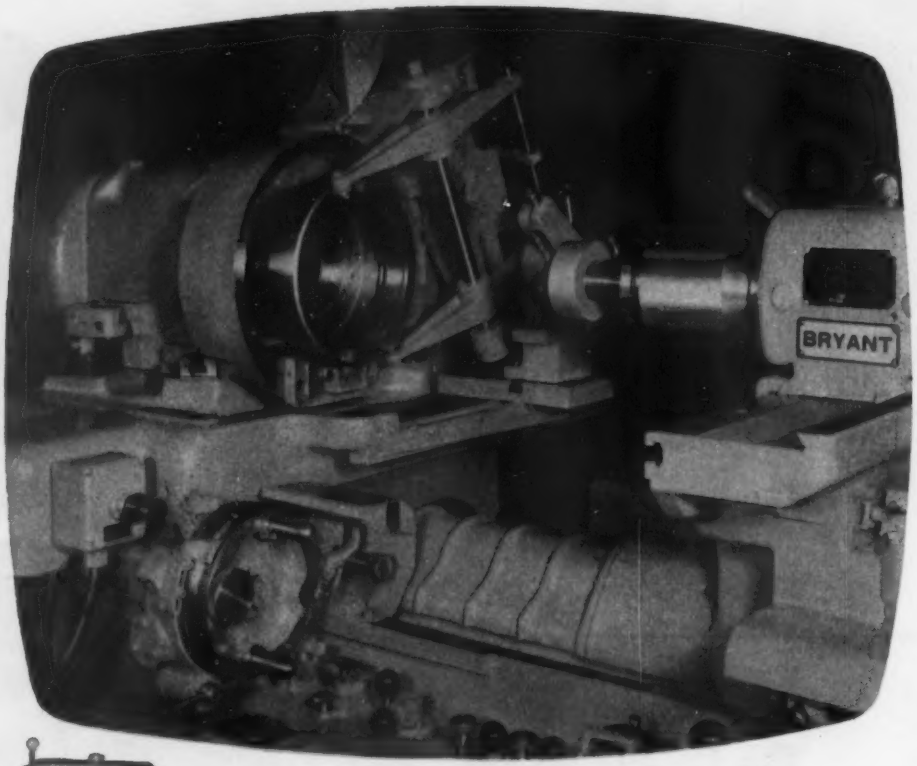

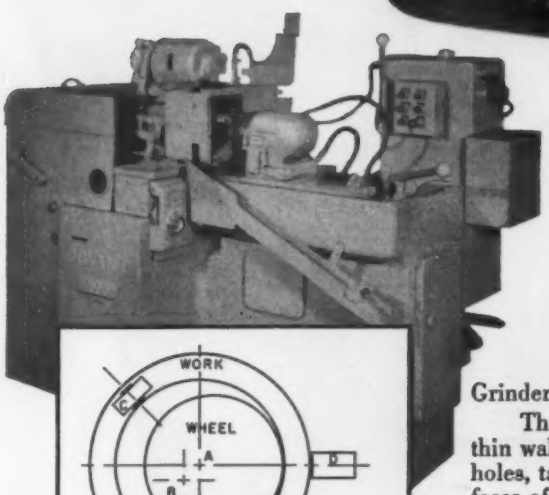

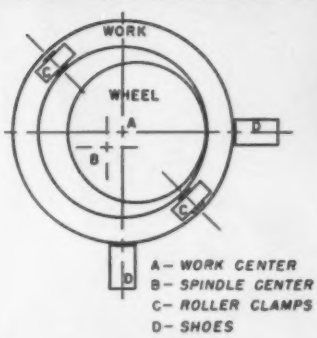

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control. When this is not done management has two choices. It can silently fold up its tent and move away, or it can stand up and fight for its right to maintain discipline in its own shops.

Here we have what amounts to a kangaroo court. An undisciplined clique is about to pass sentence on a shop engineer who is doing the best he can.

In our free enterprise system freedom does not mean license. It means discipline. The laws of the physical sciences and the principles of economics must be adhered to. The rights of others must be respected, not only in acknowledgment of the moral law, but also for the sake of good business.

Leaders in management, leaders in labor organizations, are poor citizens and worse Christians when they condone, and in some cases encourage, a disregard for the rights of others on the part of their followers. In the case of the bum's rush we advise our foreman friend, Al, as follows: Be firm; demonstrate what the freedom in "free enterprise" really means. Throw the bums out!

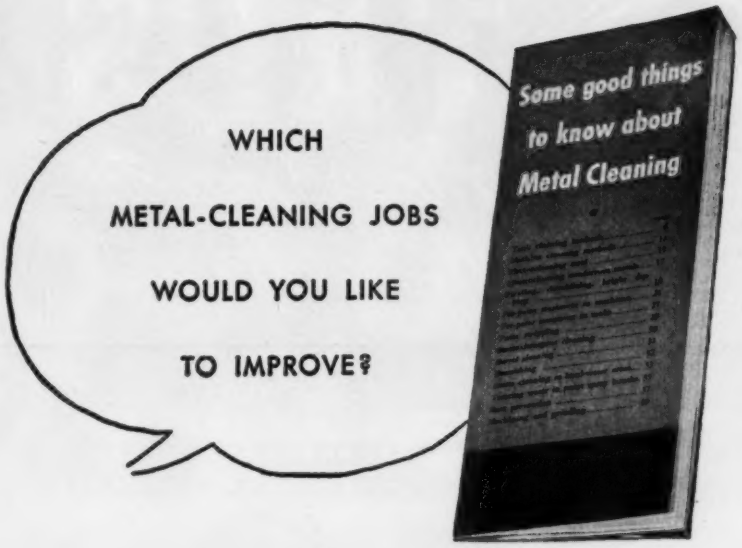
Peter A Seward
Swampscott, Mass

•

IT WOULD SEEM TO ME that Al is a little too critical of this new engineer, and that his men are simply carrying out or reflecting his own thoughts and opinions.

Every machine shop is just a little different from every other machine shop although of the same general type. For instance, in one shop bed plates may be planed. In a competi-

"Remember when Elmer was bragging about how his wife never gets HIS pay envelope? Well, she says it's true . . . She takes the money, lets him KEEP the envelope."



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TAPS

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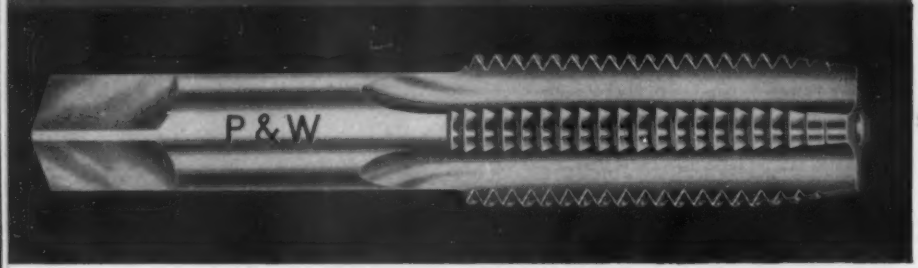
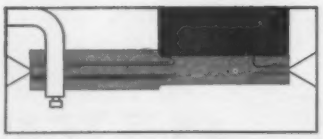
Always Accurate



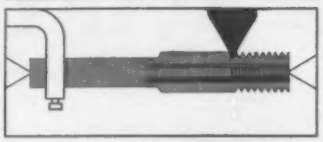
because.. All Important Operations on Pratt & Whitney Ground Thread Taps ARE PERFORMED ON CENTERS!

SHANKS GROUND on CENTERS



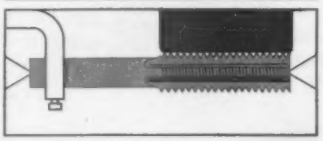
Shanks are precision ground, *on centers*, as the first step in insuring concentricity between the chuck and the threads on the tap itself.

THREADS GROUND on CENTERS



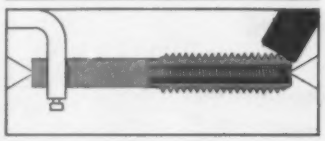
Threads are precision ground, *on centers*, to insure a uniformly perfect thread form, the basis of clean, accurate threads in the finished work.

O.D.'S GROUND on CENTERS



Outside diameters are precision ground, *on centers*, another step in maintaining necessary concentricity between shank, pitch diameter and crests of the thread.

CHAMFERS GROUND on CENTERS



Chamfers are ground, *on centers*, thereby guaranteeing equal distribution of the chip load per tooth, on each land of the tap, as well as close control of tapped hole size.

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MACHINE TOOLS • CUTTING TOOLS • GAGES

tive shop they may be milled. Both shops have developed levelling, clamping, holding, and positioning techniques peculiar to their product and their individual machines. Let a man who is trained on and is familiar with planer technique transfer to a milling shop and he will probably make a number of errors or run into various difficulties until he absorbs the new and different technique involved.

In the new job, for instance, if not warned, he may set up the machine using 10-in. cutters whereas the shop has found out the hard way that 16-in. cutters are necessary to finish the job in the allotted time. Or he may be gang-milling with four cutters and sending two cutters to the cutter grinder for sharpening, overlooking the fact that the cutters must be ground as a unit and all kept to the same diameter. He may use speeds and feeds too fast or too slow for the material he is working on unless he is specifically instructed as to what the shop has found best for the particular purpose at hand. He may decide to climb-mill on the way back after the plate has completed its forward cycle only to find out that he now has a totally different and unacceptable finish on his plate. There are a thousand errors he can make, and some of them he will until such a time as he has absorbed the new technique.

What is true of the shop man is equally true, and more so, of the engineer. In one shop they may have product manufacturing and each machinist may machine a part completely. In another shop they may have process manufacturing, and a man may be confined to one machine. If an engineer designs a holding fixture for a mill that will hold and permit the milling of six similar pieces at a time, this fixture will be a mistake in the shop where the custom is for each man to work on one piece at a time.

No engineer is experienced in all branches of engineering. At one time I was called on to design some round dies for extruding rubber. After the dies were made, I was shocked to find out that my extruded stock was larger in diameter than the die they were made from. I learned then that rubber swells when it is extruded, and that dies for any size round have to be made smaller than the size stock desired. *Now* I know that. And if a square rubber stock is to be extruded, the dies will have to be made with involute sides to compensate in advance for the swelling that is about to take place.

Aluminum can be hand or ma-

chine-spun quite readily. Stainless steel on the other hand work-hardens so fast while being spun that it has to be re-annealed several times or continuously annealed. All these things are learned by experience, but no one man knows them all, or can learn them all in school.

It should be expected then that any new man, mechanic or technologist, will have to work through an indoctrination or breaking-in process before he is familiar with the shop tempo and can take his proper place in any organization. Supervisors should understand this, and should impress this fact upon their men so that they in turn will look with toleration on the new man's initial moves.

Give the guy a break! You warm up an auto or a horse before you call on it for speed; let your new engineer run a few trial heats before you try him out on the four-minute mile. This man Bannister doesn't go down in my book as an Adonis, and he didn't break even time the first time he tried for a record, but Oh what a guy he is now—when the chips are down. Your new engineer will probably shape up too after he is warmed up.

James K Matter
Detroit, Mich

•

THE DIFFICULTY which Al is experiencing as a result of the animosity toward the new engineer is not an uncommon problem. The fault is not really with the new man or his work. Evidently the morale in the shop is very low and the men are ready to seize any and every opportunity to complain.

Working toward a common goal helps to form a strong team spirit and a cooperative attitude among the

"I ask for sweeping authority . . . and what do I get!"

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BULLETIN No. T-583

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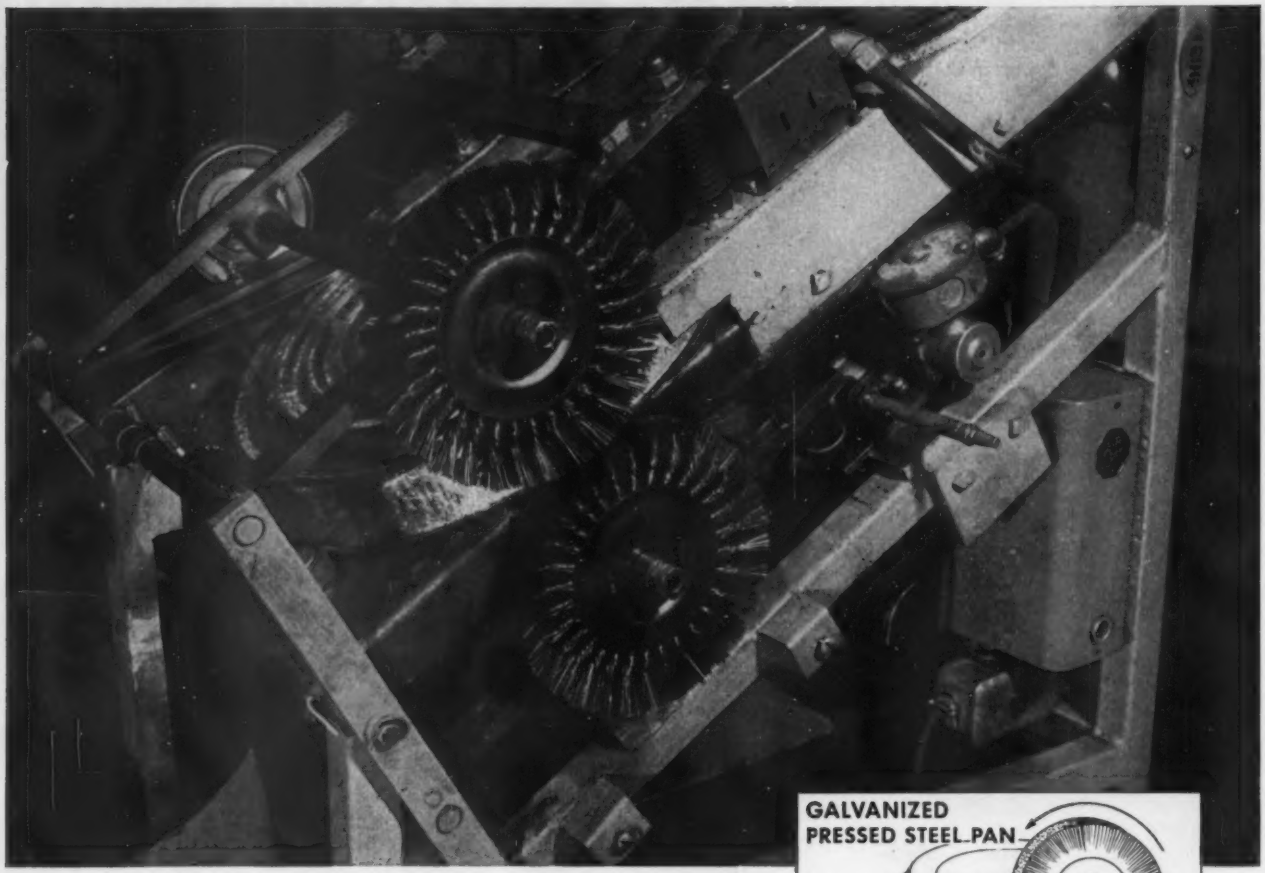

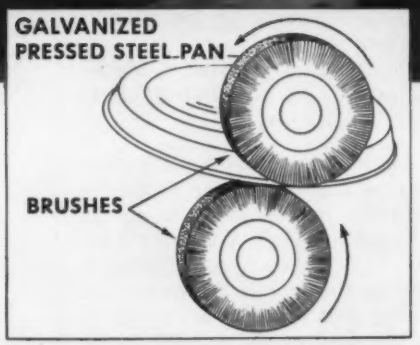

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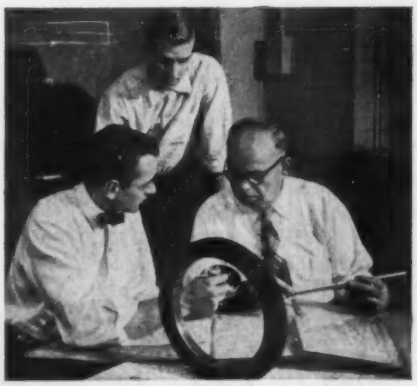

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men. However this same strong feeling will grow whether the objective is a good, constructive one, or a destructive one. Unfortunately the existence of a common enemy seems to create a stronger bond than does a common friend or a common goal. It is the foreman's obligation to build the right attitude among the men so they will give the new engineer a fair opportunity to get oriented.

This work of producing the correct attitude in the men is not something which can be accomplished in a week, nor can it be accomplished by the occasional exertion of a little effort. It is the result of years of persistent, purposeful attention and effort in this direction. Once the right attitude has become established these minor problems are very easily handled if they do arise.

H Koslow
Bronx, NY

•

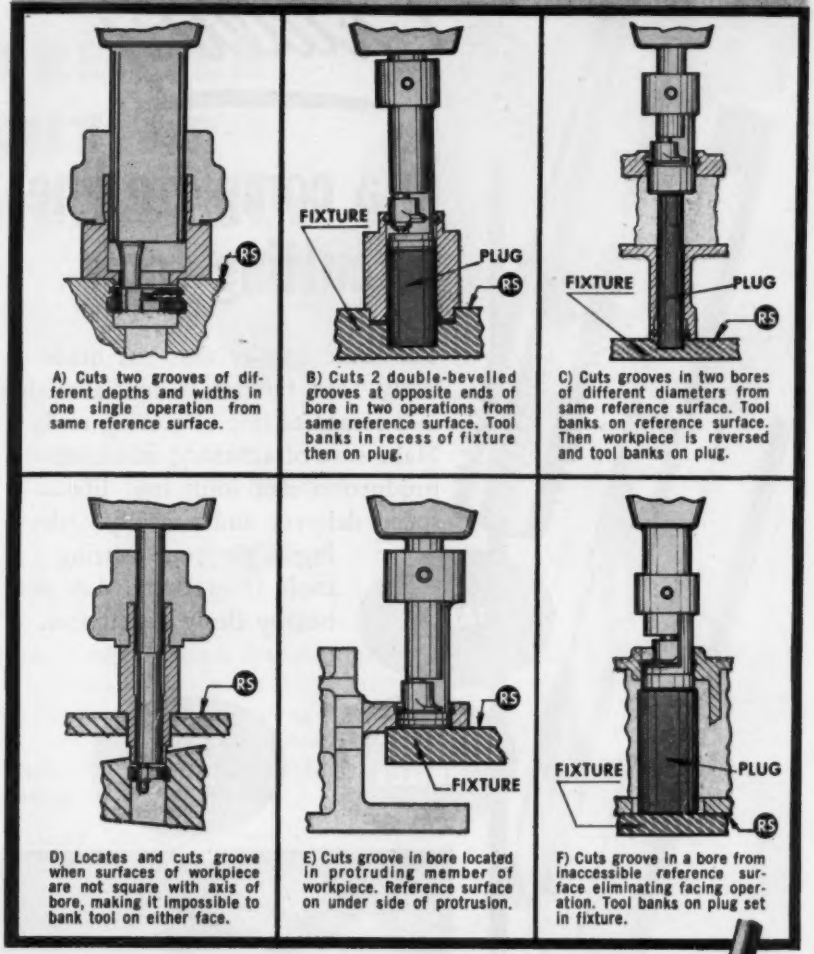
I CAN REMEMBER quite clearly how bewildered I was as a boy going into my first job. I was quite clumsy on account of the rough treatment I received from some of the other boys. The foreman—who was of the old school—a whip-cracking driver, did not make me feel any better. My Dad saw what this kind of treatment was doing to me and advised me to quit.

The very next morning the works manager approached and asked me how I liked the job. I told him I liked the work but not the people I had to work with. He asked me to stay another week before I made a decision.

Twice within the following week the manager stopped to talk to me. That fact alone was enough to get the boys off my neck. I was treated with new respect by both the foreman and the employees. That works manager had ability—both engineering and human-wise. He did not

"And to think the Smith Engineering Co said my design was worthless!"

Even Unskilled Labor Can Use This Versatile Tool Accurately! It Simplifies Internal Grooving Problems, Cuts Production Costs!



A) Cuts two grooves of different depths and widths in one single operation from same reference surface.

B) Cuts 2 double-bevelled grooves at opposite ends of bore in two operations from same reference surface. Tool banks in recess of fixture then on plug.

C) Cuts grooves in two bores of different diameters from same reference surface. Tool banks on reference surface. Then workpiece is reversed and tool banks on plug.

D) Locates and cuts groove when surfaces of workpiece are not square with axis of bore, making it impossible to bank tool on either face.

E) Cuts groove in bore located in protruding member of workpiece. Reference surface on under side of protrusion.

F) Cuts groove in a bore from inaccessible reference surface eliminating facing operation. Tool banks on plug set in fixture.

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make me out a squealer by bawling out those responsible for the rough treatment. He did, however, make the foremen understand the employees were entitled to human treatment. He trained supervision in the art of enforcing the rules without driver methods.

Getting along with others depends 98% on a man's own attitude. We should help the new employee because in that way we eventually help ourselves.

A E Salmons
Philadelphia, Pa

•

IT SEEMS TO ME that a very poor spirit exists in Al's department. Those fellows who are making it so tough for the new engineer must be possessed of a very poor memory. They have forgotten their first days on the job and how difficult it was to become oriented even when the other men were helpful.

It is the duty of the supervisor to see that every new man who is hired is given a fair chance to demonstrate his ability. Giving the man a chance will show the supervisor whether or not the new man has the aptitude and ability required for the job. It may also show that the man has some real aptitude for another position in the plant which can be developed into an ability of great value to the organization.

In this case it is evident that some of the fault lies with management. The new engineer should not have been put into a position where his work affects the men's bonus payments until he had gone through a training period. It is obvious that whenever a man is employed in a new job he has to go through a pe-

"Now Son . . . You take that right back and tell Joe to quit fooling around and give you the 'roll stretcher.' . . ."

riod of adjustment, a period of getting used to the new work and the new environment. Whether it is formally recognized or not, this is a time of learning and training.

William Martin
Brooklyn, NY

•

IT LOOKS TO ME as if Al has collected a prize bunch of cut-throats and is going to have a hard time convincing them of the error of their ways —if he ever does.

Frankly, I don't quite see how they got that way in the first place, but let's be charitable to Al and say he inherited this disagreeable outfit. First of all he has to remind them that he is boss—and make it stick—even if it means firing a few of the ringleaders. I agree with Ed that the engineer should be backed up one hundred per cent, even if some of this project may seem to have haywire tendencies.

It is a pretty safe bet that management didn't hire him because he had a college diploma or they like his looks. Maybe, like some of us do when we go into a new job, he brought some new ideas with him and inadvertently stepped on a few toes in the process of putting them into practice. Any deviation from the normal routine has a tendency to upset some individuals; when they suddenly become exposed to a new idea they are inclined to view it with suspicion, if not actual hostility.

So, Al, give the new engineer a break, and see that the men do likewise. Then you will have the satisfaction of knowing you have done the best for all concerned. If the new man has something on the ball he will appreciate your cooperation —if he fails to measure up to advance notices you will have the inward satisfaction of knowing you gave him a fair shake.

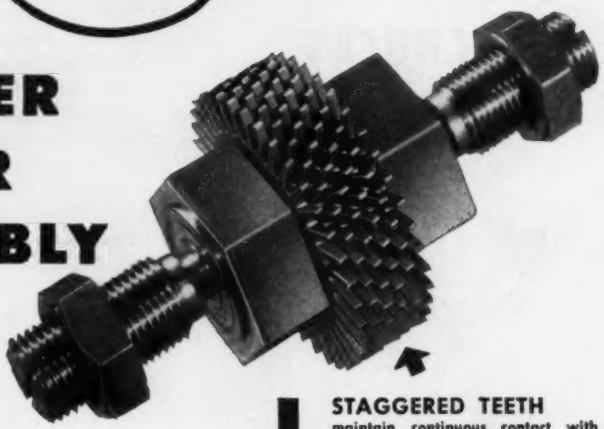
Robert S Alexander
Glastonbury, Conn

•

AL IS NOT TOO CRITICAL of any gang that attempts to dictate as to who shall be permitted to work in the shop. Piece-rate setters, time clerks, store-room keepers and others upon whose record the size of the pay checks are figured have a tough time as it is without feeling that they must mollify a certain group under the penalty of a concerted action against them and that if they do not toe the line, drawn by the said group, they will soon be canned. Any foreman who does not catch the incipient start of such a gang is headed

NEW! BESLY 2½" Wise Type

DRESSER CUTTER ASSEMBLY



• DRESSES BETTER
• LASTS LONGER

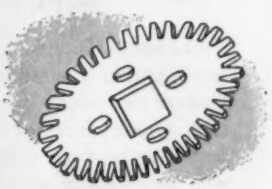
Costs only $8.25

Unlike broad toothed dressers, this new Besly Dresser Cutter Assembly sharpens abrasive discs *without crushing the surface.* Discs last longer, perform better. Grinding characteristics are not "softened" by the dressing action.

A unique "tru-square" spindle and interlocking spacer buttons lock cutters firmly in a staggered arrangement which provides a series of points of contact with the disc at all times. Non-staggered cutters "dig" into the abrasive—cause the dresser to vibrate and "bounce". Ball bearing holders provide almost frictionless rotation of the entire assembly. The new Assembly fits all Besly grinders using 2½" cutters and can be adapted to other dresser holders. Try one and cut your dressing costs. Send purchase order.

STAGGERED TEETH
maintain continuous contact with disc—prevent "digging" and dresser "bouncing" common to other dresser cutters.

CUTS INSTEAD OF CRUSHING
Slim fingers *pick off* abrasive grain, require less pressure than broad toothed cutters, last longer.



FASTER, EASIER ASSEMBLY
Raised buttons on cutter eliminate need for spacing washers. Replacement cutter sets are taped together for quick mounting and proper "stagger". Just slip on and remove tape.

NO CHEWED SPINDLES
Square arbor plus interlocking buttons replace easily worn keyways, maintain proper tooth "stagger".

Of Course You're Coming!

Be sure and see new Besly developments, including the Wise Type Dresser Cutter Assembly, the Besly-Bowen Radial Head Grinder that is making production records at leading metal-working plants, and other new Besly single and double spindle grinders.

BESLY

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CORPORATION
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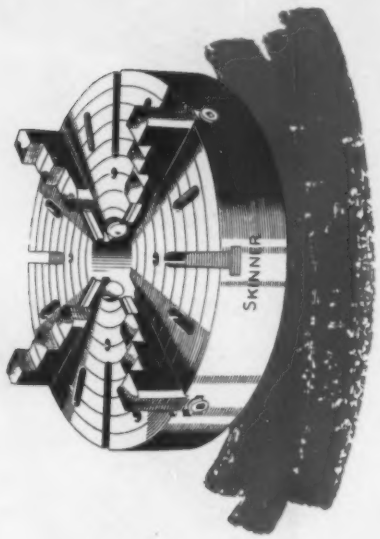
precision independent

CHUCKS



POWERFUL!
ACCURATE!
SAFE!

Skinner Independent Chucks are available in various models for medium and heavy duty tool room and general machine shop work. Sizes range from 4½" to 36", with semi-steel or steel bodies. All other parts are heat-treated alloy steel. Jaws are solid reversible or two-piece with reversible tops for either internal or external gripping. Soft blank top jaws available. The body surrounds more than 60% of each operating screw for the full length of the screw, to assure proper alignment and long life.

Write Skinner or your nearest Skinner distributor for illustrated folder.

THE CREST SKINNER CHUCKS® OF QUALITY

THE SKINNER
CHUCK COMPANY
203 Edgewood Avenue, New Britain, Conn.

for trouble; very serious trouble indeed.

There are basic principles in shop management that the foreman must know and rememeber. Probably the most important one is that it is the foreman himself who makes the decisions. He can gather all the information he wishes; he can get opinions and suggestions, but the final decision must be his own as long as he is to be a satisfactory and efficient foreman.

A good example of what a first-class foreman can do in a crisis is the case of the machine shop and maintenance foreman at a medium-sized malleable iron foundry. The crane operator was a colored man who was a good and reliable workman, and also one who could stand the heat of the furnace when recharging. One day three brothers were hired into the maintenance gang and these three men immediately started planning to get the crane operator fired because they did not like colored men. They spread dissatisfaction among many of the other men and waited their chance. They concluded the time was ripe on the day that the manager and the superintendent were away at a convention and the machine shop foreman had been left in charge. Just before the furnace was ready for the pour, a delegation (consisting of the three brothers) from the maintenance gang came to the foreman and told him that he would have to fire the crane operator at once or the maintenance and machine shop departments would all quit. They had a trumped-up charge against the crane operator as an excuse for immediate action and they thought they had the foreman on the spot for this was the first time he had been made acting superintendent and so would not want anything to happen to shut down production.

The foreman said he would settle this matter immediately and told the delegation to meet him in the machine shop in ten minutes. The grinning delegates went back and in less than ten minutes the foreman came in with the time clerk and the first thing the foreman did was to fire the three brothers. Then he said that any man who was not entirely satisfied with his job and who wished to leave the company could do so at once and he would have his pay check made out as quickly as possible.

This determined attitude was entirely unexpected by the trouble-breeders and their misled associates, but the entire gang must have realized the foreman was right, for not a single man stepped forward to get his pay check. No mention was made by the foreman about the crane operator but, of course, all knew what the entire matter was about.

The foundry continued production and as far as could be determined the men in the maintenance and machine departments actually felt a lot better and now admired their foreman for his prompt decision and positive action.

George P Pearce
Albuquerque, NM

THE WORD "ENGINEER" seems to really cause a fuss in many shops throughout the nation. We often wonder at the charm of this word and its apparent ability to cause frustration in a plant. What has happened to set up such a feeling and what can be

BY ADDING THIS MARKING OPERATION TO THE MAJOR ONE — WE REDUCED HANDLING TIME A LOT — IN FACT — WE NOW GET TH' MARKING OPERATION FOR NOTHING!
BASED ON PRESENT CONDITIONS — IF YOU WERE TO ASK ME — I'D SAY YOU'RE GETTIN THE WHOLE OPERATION FOR PRET' NEAR NOTHIN!
"THERE IS ONE IN EVERY SHOP"

DISSTON
HAS THE EDGE®

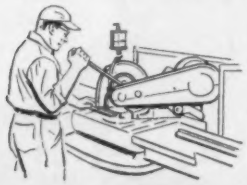
In Metal Cutting Circular Saws

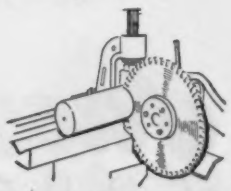
A sure way to reduce the cost of cutting metals and plastics is to use Disston circular saws. Tough, smooth-cutting, long-lasting. Their superior edge-holding teeth mean less frequent sharpening, less down-time losses.

DISSTON SOLID-TOOTH SAWS Use Diss-Croloy for production cutting of non-ferrous metals such as copper, brass, aluminum, magnesium; and plastics such as Formica, Masonite, Lucite, Plexiglas, Micarta. Diss-Croloy saws are made of a special Disston steel, have long cutting life. Blades are made in 6″, 8″, 10″, 12″, 14″, and 16″ diameters. Disston also makes a medium price alloy blade for non-continuous production-cutting, available in same sizes as Diss-Croloy.

DISSTON (inserted-tooth) INTERLOCK SAWS—IMPROVED TYPE

Proven best where heavy feeds *not* finish is the primary requirement, as in sawing large forgings and billets. Square and beveled teeth are individually interlocked in the blade. Deep gullets remove chips quickly, give saw maximum clearance, cooler cutting. Where closer tooth-spacing is required in an inserted-tooth design, use Disston Sectional Interlock Saws. Made to cut through steel I beams, channels, rails, and the like.





Order Disston metal cutting circular saws from your Industrial Distributor. He will give you expert advice and prompt service on these — and other Disston metal cutting products.

HENRY DISSTON & SONS, INC., 420 Tacony, Philadelphia 35, Pa., U.S.A.

Other factories and branches: Toronto, Ont.; Seattle, Wash.; Chicago, Ill.

There is NO COMPARISON with a Jacobs

If you don't wear a gold service pin you probably won't remember when "Jacobs" *wasn't* the name for the finest drill chuck. Since Mr. A. I. Jacobs started it all, back in 1903, continual painstaking and specialized research has been lavished on Jacobs Chucks.

The Plain Bearing Jacobs Chuck pictured is undoubtedly the best known in the world . . . and with good reasons. It is a *precision* chuck capable of greater accuracy than any comparable chuck made today. It is a *strong* chuck, longer lasting on the job. It is a *hard-holding* chuck with a grip of tremendous power.

These good reasons add up to the unquestioned, uncompromising quality that makes your selection of drill chucks as easy as remembering the name *Jacobs.*

JACOBS AND YOUR LOCAL DISTRIBUTOR
are ready to deliver the chucks you need and the service you deserve.
first in chucks . . . first in service

Jacobs
CHUCKS
If it's a Jacobs-it holds

done to stop the foolishness? The answer to these questions will solve the problem of the "bums' rush" facing Al in his shop.

Going back many years, the engineering profession was nothing but a group of individuals who had graduated from college and, in some instances, just felt they had more technical knowledge than the average worker. Those who obtained the right to the title of engineer upon graduation from college were trained to think they were above average and in many instances encouraged to marry the boss's daughter as a means of stepping up even further. At any rate, between these individuals and a group who emerged as "efficiency experts," the engineering profession was nearly ruined. In fact, even today it has never lived down the stigma in some specific locations. Engineers who went into the shop had drilled into them that they were a superior race and that they must treat the worker as dirt under their feet. Never tell the worker anything about what you are doing, or what you intend to do, because he might be as bright as you are and become an engineer. Keep all labor in its place and act extremely superior even if you don't know the answers.

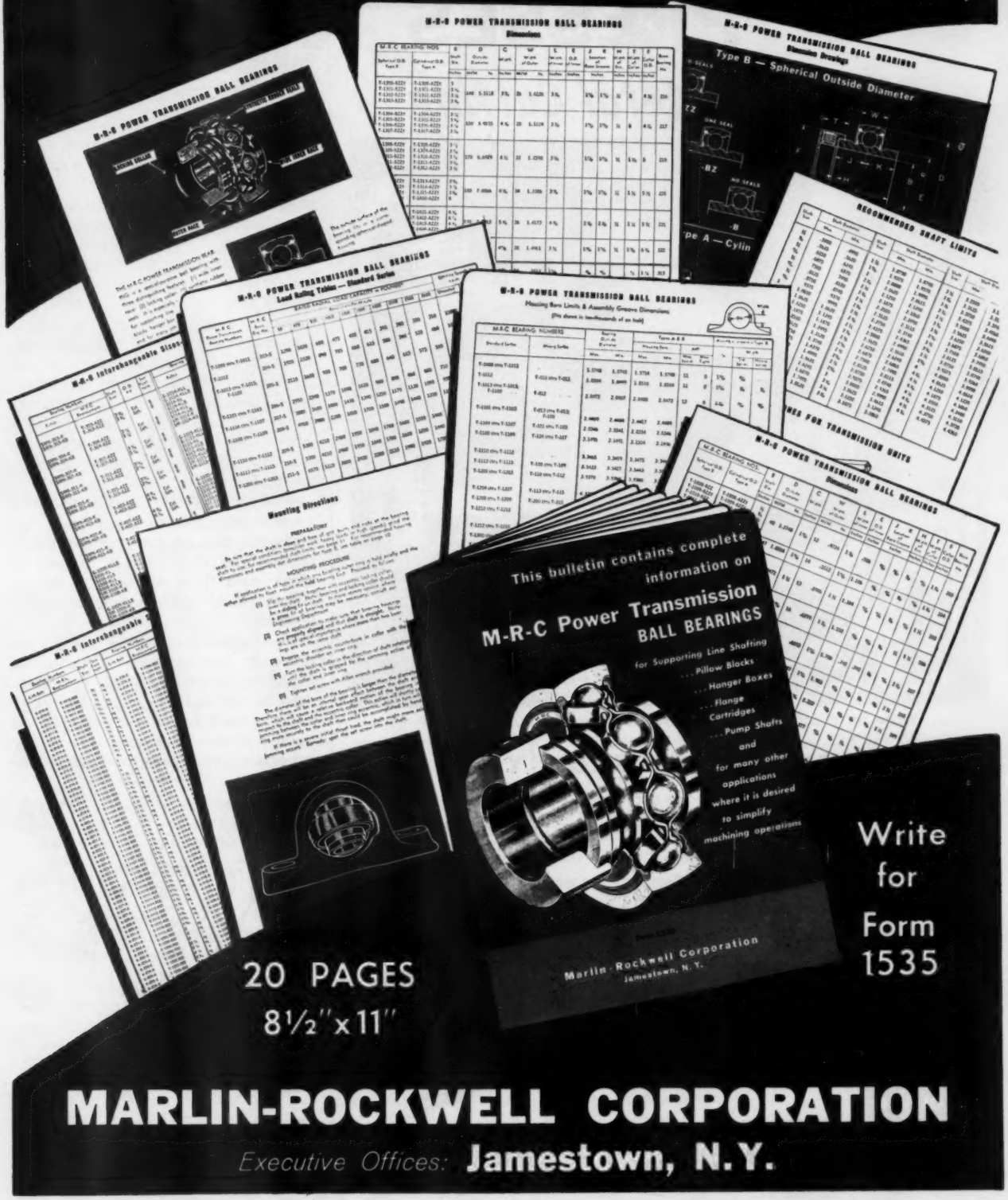
Whether we liked it or not, for a period of years this was a general attitude. Men, both young and old, went into our shops and made fools of themselves using the title Engineer to cover up their desires to be the "master of all techniques."

Thus we see that with this background any engineer today has at least two strikes against him when he enters the engineering profession. There are spots where engineers do not come in contact with other labor and never feel the anger which still smolders in the shop. These engineers are protected, but when they do get out into the shop conditions

New catalog — complete information on

M-R-C POWER TRANSMISSION BALL BEARINGS

with M-R-C Synthe-Seals — the most effective of all seals, excludes dirt and retains lubricant



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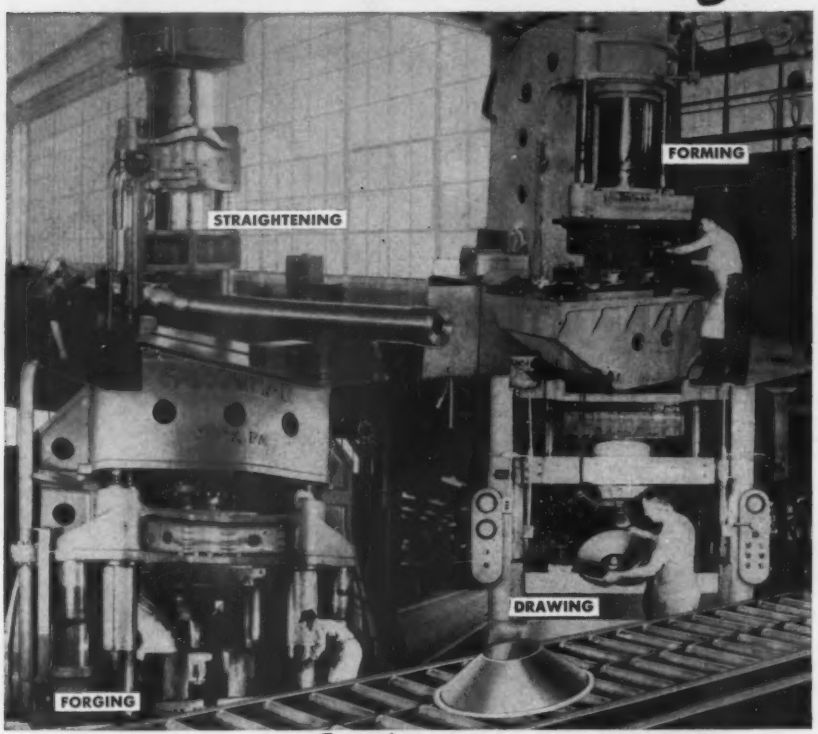

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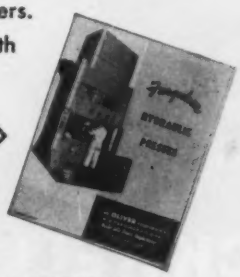


THE OLIVER CORPORATION
Farquhar
A. B. FARQUHAR DIVISION
THE OLIVER CORPORATION, 1506 Duke St., York, Pa.

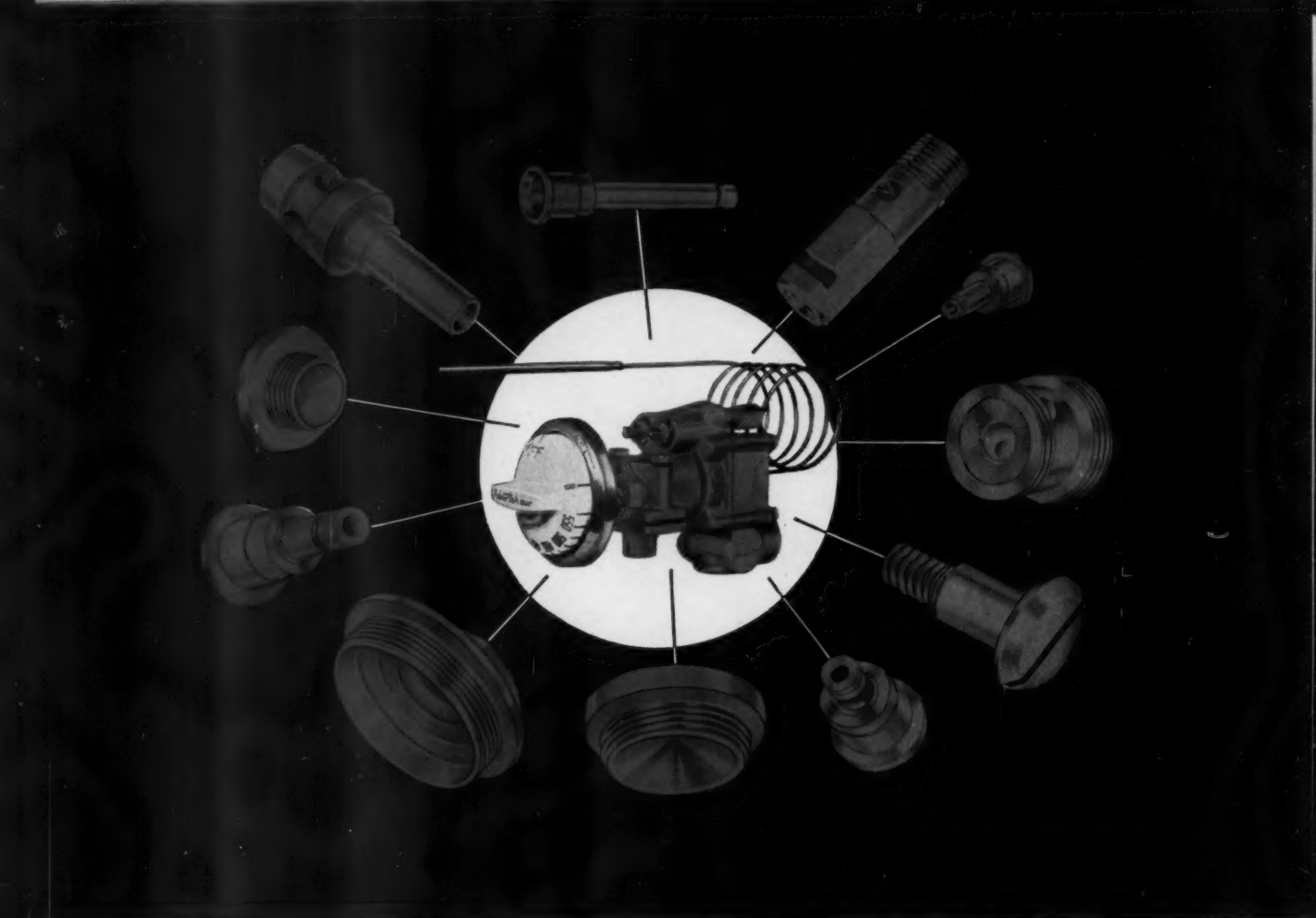
are suddenly fermented because the engineers do not know how to act. They, too often, feel superior because of their college education and consider themselves strictly white-collar workers.

The laborer on the other hand has spent his time working at the job. He knows how to do the work, and if he is alert and awake has many good ideas on how to do it better. Suggestions are made for changes—many are worthy of award. So when he comes face to face with the engineers who have nothing but book knowledge, the laborer feels he is just as important as the engineer, and actually he is. Maybe a little more so. The only difference is the ability to finally complete the desired project. Our engineer, due to his training, has that knowledge, while our laborer generally doesn't have.

Certainly this fine point doesn't call for the superior attitude that is taken by so many engineers. Indeed this is the core of our trouble. The solution can only come by better educational systems and the development of more of the cooperative type of universities. Here the young engineer learns his way around the shop. He learns to live with men who know the fundamentals of production and learns to work with them. Here he is able to see for himself the values that can be derived from working with these men. He finds out that he can become one of them if he will humble himself to work with them on their problems and to discuss with them what should be done.

No doubt Al's attitude toward the engineer has allowed the shop to build up its resentments. If a foreman is not satisfied with his engineering staff, he should not blow off to his men. He should go to the superintendent or to the head of the

"I'm planning a huge shop party this year . . . I'm even going to have beer running through the coolant pumps!



All these parts of the famous Robertshaw-Fulton thermostats are

MACHINED FROM REYNOLDS ALUMINUM

for not one, but seven sound reasons!

1. **Free-cutting Reynolds Aluminum screw machine stock possesses a definitely superior machineability over other metals.**
2. **By switching to aluminum for screw machine parts and cast bodies, Robertshaw-Fulton cut shipping weight approximately 1 lb. per item.**
3. **Aluminum holds lubricating grease at temperatures of 250°–350° F, where the previous metal did not.**
4. **Aluminum parts are singularly free from corrosive attack by the hydrogen sulphide found in the "sour" heating gases of many areas.**
5. **Aluminum parts do not cause certain fuel gases to break down and deposit carbon, as other metals do.**
6. **Aluminum can be color-anodized, permitting a color-coding system that eliminated a costly number-stamping operation on several parts.**
7. **Exterior aluminum parts, too, are now color-anodized for appearance, eliminating a polishing and plating process once needed.**

How about your screw machine products?

Consider the many advantages of Reynolds aluminum screw machine stock for your products.

Job for job, aluminum alloys machine at greater speeds and feeds. And unit costs for material, handling, and shipping step down because aluminum gives you *three times the number of pieces per pound!*

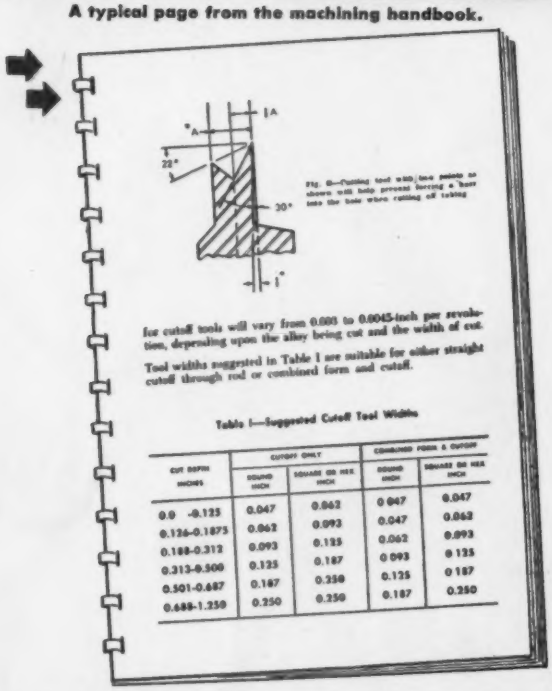
For assistance on any phase of the use of aluminum in your plant, call your nearby Reynolds office or distributor listed under "Aluminum" in your classified phone book. Write on business letterhead for your free copy of the 124-page handbook, "Machining Aluminum Alloys," and an index of other Reynolds literature. *Reynolds Metals Company, 2523 South Third Street, Louisville 1, Kentucky.*

See "Mister Peepers", starring Wally Cox, Sundays on NBC-TV

REYNOLDS ALUMINUM

CUT MACHINING COSTS WITH ALUMINUM

A typical page from the machining handbook.



for cutoff tools will vary from 0.005 to 0.0045-inch per revolution, depending upon the alloy being cut and the width of cut.

Tool widths suggested in Table I are suitable for either straight cutoff through rod or combined form and cutoff.

Table I—Suggested Cutoff Tool Widths

CUT DEPTH INCHES	CUTOFF ONLY		COMBINED FORM & CUTOFF	
	ROUND INCH	SQUARE OR HEX INCH	ROUND INCH	SQUARE OR HEX INCH
0.0 -0.125	0.047	0.062	0.047	0.047
0.126-0.1875	0.062	0.093	0.047	0.062
0.188-0.312	0.093	0.125	0.062	0.093
0.313-0.500	0.125	0.187	0.093	0.125
0.501-0.687	0.187	0.250	0.125	0.187
0.688-1.250	0.250	0.250	0.187	0.250

THIS HANDBOOK TELLS YOU HOW

The handiest, most helpful handbook you can get on the machining of aluminum alloys is yours for the asking. This book evaluates the various aluminum alloys and recommends machining methods and tools that give maximum production economies. There is a special section on automatic screw machining. Every designer, production engineer, plant manager and machine shop superintendent needs this 124 page "Machining Aluminum Alloys" on his desk. Single copies are available without cost when requested on your letterhead. Or call your nearby Reynolds Distributor. A complete index of technical literature is also available. *Reynolds Metals Company, Post Office Box 1800-JJ, Louisville 1, Kentucky.*

See "Mister Peepers", starring Wally Cox, Sundays on NBC-TV

REYNOLDS ALUMINUM

MODERN DESIGN HAS ALUMINUM IN MIND

engineering department and talk over the problem.

Many of the engineers in charge are beginning to see that friction and ill-will can gain them nothing. They are already changing their thinking. If they are ready to do so then it is the foreman's job to give them a chance in the shop. It is the foreman's responsibility to see that his workers in the shop give the engineer a chance.

Make sure that your company engineers are registered. They have a strict code of ethics and try to live by it. They know that they must see the other fellow's viewpoint and they are trying to correct conditions. We are not perfect—there are a few unscrupulous members—but we don't retain them long if we can find them and sort them out.

Charles D Townsend
West Hartford, Conn

THE WHIPLASH

Will the shop men tend to work harder or faster if they are aware that the foreman is making notes on their work habits? Or will they grow resentful at his apparent lack of faith in them?

THERE ARE SEVERAL FACTS which the editor has overlooked. One is that the application of the whip has seldom created anything but resentment. Another is that men give their best only when they have reason themselves to do so, and seldom from a sense of duty. If a foreman can engender in his men respect and liking, he has most of his problems licked. It is only one further step to create a sense of pride of workmanship and accomplishment. A public

"This expecting time off to get a haircut every four or five months, has to stop, Beckworth!"

New
RIDGID
200 Tripod Power Drive
with
SPEED CHUCK

Light Weight...
Easily Quickly Set Up...
Built-In Folding
Tool Tray and
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Power for any hand pipe tools — ⅛" to 2" pipe, ¼" to 2" bolts; geared tools to 12".

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Leg Spacing and Tool Tray assure solid rigidity, greater strength . . . No front leg to obstruct swing of die stock handles.

Fast Easy Chucking, new principle—guaranteed to grip tight both forward and reverse, won't slip, even with geared tools . . . 3-jaw centering device turns with pipe . . . Extra-powerful motor, larger brushes, longer commutator.

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Work-Saver Pipe Tools

SKIL'S New Disc Sander

SKIL Disc Sander
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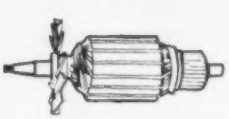
These Big Features Make SKIL Your Best Buy in Disc Sanders!



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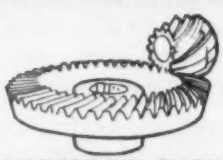
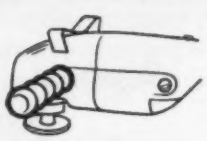
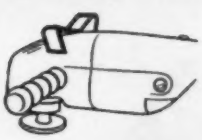
Gives 30% more power! Maintains high load speed . . . yet runs cooler!



PRECISION-CUT GEARS!
Spiral bevel gears *cushioned in synthetic rubber.* For longer-lasting, smoother operation!



FRONT HANDLE!
Scientifically positioned for better balance and control. For right or left hand use.



TOOL REST!
A SKIL feature for added convenience. Protects work when sander is laid down.

CORD PROTECTOR!
Extra-long rubber protector keeps heavy duty cord away from work area for greater safety.

REAR HANDLE!
Scientifically contoured to fit the hand. More comfortable to use and carry to the job.

TRIGGER SWITCH!
For greater comfort, also has continuous operation lock. Dustproof, 2-pole design for long life.

INSPECTION PLATE!
Extra large, easy to remove, for complete inspection and cleaning of brushes, commutator.

SPINDLE LOCK!
Conveniently located at front of tool housing. Makes accessory changes far easier.

WEAR STUD!
Stud of durable, hardened steel protects tool from damage to rear housing.

Pays Its Way on 101 Jobs

in Production and Maintenance ...on the Job or in the Shop

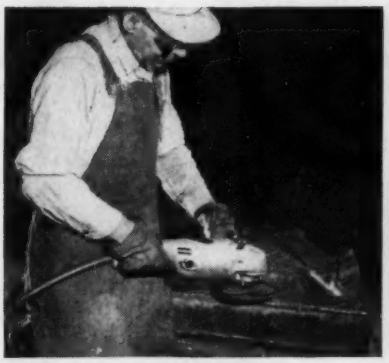
- **Accessory Changeover permits easy switching from job to job including sanding, grinding, buffing, wire brushing.**
- **Faster Working! 30% more power avoids stalling, increases working speed; from every accessory.**
- **Easier Handling! New compact design with shorter length and lighter weight permits all day fatigue-free use.**
- **Lower Maintenance! Large inspection port permits frequent and easy checking and cleaning of commutator and brushes. Oversize gears, shafts and bearings "take it" on the toughest jobs.**

The pictures tell the story! This versatile sander will pay for itself in no time—speeding maintenance and production on scores of jobs. Wherever the need for a tool like the SKIL 852 arises, this sander will do a matchless job—with important savings in man hours.

It's powerful . . . fast . . . light . . . safe. The new front handle makes more efficient use of tool weight, makes all-position handling possible. Model 852 SKIL Disc Sander is rugged, practical and dependable!

No matter what your product . . . no matter what phase of its production is involved . . . if the problem concerns grinding, polishing, sanding, or finishing . . . get the SKIL answer for top efficiency.

FREE! Let Your SKIL Distributor Show You in a Convincing Demonstration and FREE Trial . . . that "SKIL is the Answer" to Your Metal Finishing Bottlenecks!



Grinding heavy weld bead with SKIL sandpaper discs.

Grinding weld bead in close quarters with flex-type grinding wheel.

Finishing and smoothing casting with SKIL sandpaper discs.

Cleaning scale and spatter, from metal with SKIL wire brush.

Used with sandpaper discs, SKIL sander quickly removes stencil marks from crates to permit re-use.

Grinding casting with SKIL cup grinding wheel. SKIL cup wheel guard attaches directly and easily to sander.

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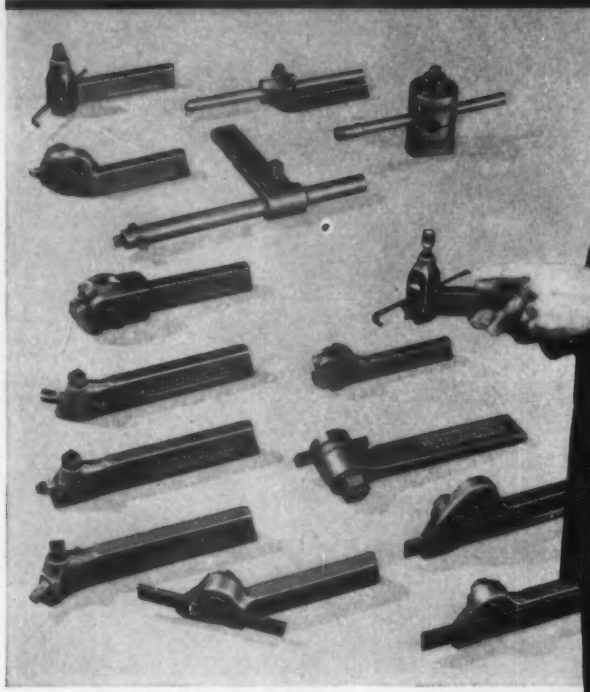
YOUR Williams Distributor Supplies a Complete Range of WILLIAMS Tool Holders



Williams Tool Holders are available in a complete range of sizes and patterns for — turning, boring, threading, knurling, planing, cutting-off and side work. A full line of high speed and carbide cutters is available also.

These tools are correctly designed for fast set-up and precise production performance. They are drop-forged from tough quality steel . . . heat-treated for added strength . . . machined to close tolerance finish.

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It includes the latest patterns and sizes from which to choose.

pat on the back for a job well done, and a strictly private interview when it is necessary to criticize, are effective instruments in boosting morale.

The shop foreman should be available to his men and their problems at any time, and a sympathetic hearing even to seemingly minor problems is a great incentive-builder.

Suggestions for improving the efficiency of the shop should be encouraged, and it should be pointed out that shop efficiency begins with the individual. A good foreman knows how long a job should take, and who are not giving their best to the job. Watchdog tactics only create resentment and seldom improve over-all efficiency. Chronic time-wasters should be treated strictly as individual cases.

When the workman is made to realize that his chances for advancement or pay increases depend on company profits, he is usually quick to see the light.

J F Pierce
Dartmouth, Novia Scotia

•

THE WHIPLASH TYPE of foremen believes that the best way to keep people on their toes is to keep them on their knees. Fortunately, for both management and labor, this type of supervisor is becoming a rarity. The wise foreman knows the value of preserving a nice balance between too much sternness and too much familiarity. He seeks to adjust his relationship with his men so that he is neither weak nor overbearing.

Today's shop workers are indeed fortunate in the type of leadership they are privileged to enjoy in the majority of plants. I remember the

"Somehow I didn't like his tone when he called me a sloppy, inefficient worthless BUM."

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Factory Branches in All Leading Cities

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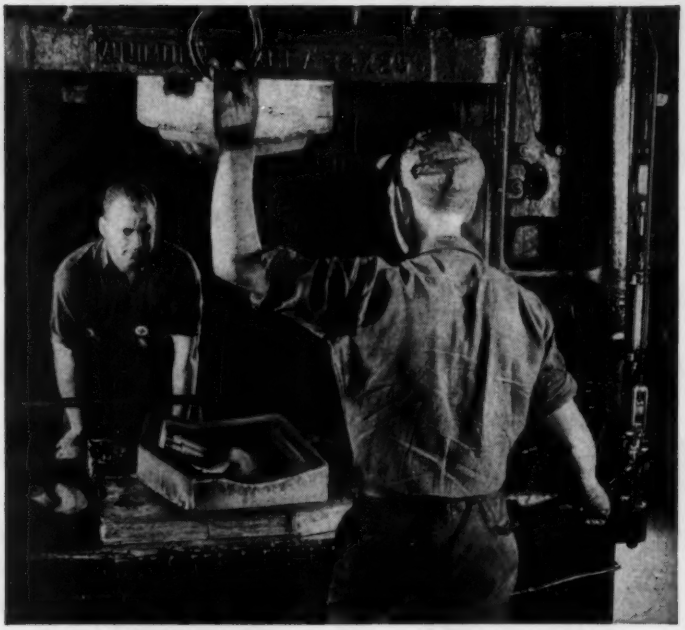
use 'dag' dry films for trouble-free lubrication



Treat your steel forging dies with 'dag' Colloidal Graphite and increase the number of acceptable forgings per die by as much as 100 percent. The *dry lubricating film* formed by colloidal graphite protects both dies and forgings. Freedom from scaling and sticking often eliminates some of the usual finishing operations on forgings, and greatly extends die life.

'dag' Colloidal Graphite is much more effective than ordinary high-temperature lubricants, including the best of powdered graphite. It is high-purity, electric-furnace graphite, specially treated by Acheson to produce microscopically fine particles. Dispersed in many fluid carriers for convenient application, 'dag' Colloidal Graphite will not burn, flake, or gum, at temperatures commonly encountered in metalworking operations.

'dag' dispersions are used profitably in stamping, deep-drawing, piercing, casting, forging, stretch-forming, and wire drawing. You'll find a surprising number of ways to use 'dag' dispersions described in our free booklet on 'dag' Colloidal Graphite for Metalworking Operations. Write for Bulletin No. 426-W3.

You can double the service life of steel forging dies

Dispersions of molybdenum disulfide are available in various carriers. We are also equipped to do custom dispersing of solids in a wide variety of carriers.

ACHESON COLLOIDS COMPANY

PORT HURON, MICHIGAN

...also ACHESON COLLOIDS LIMITED, LONDON, ENGLAND

"Best in the long run"
WENDT-SONIS CARBIDE TOOLS

Wendt-Sonis carbide tipped tools are *"Best in the long run."* Best, because they give you smoother finishes . . . allow faster feeds and speeds . . . and require less sharpening.

These cost-reducing advantages are built into all Wendt-Sonis tools. Wendt-Sonis selects the highest quality materials . . . assembles them to give you the finest tools available. For example, Wendt-Sonis carbide is quality controlled for absolute uniformity. Carbide is brazed to the tool bodies by the exclusive Wendt-Sonis "slow braze" process to insure a strong bond.

The complete line of high quality Wendt-Sonis carbide tipped tools, blanks and inserts are available at your local industrial distributor. Buy through him. His personal interest in your needs, plus his nearby location and training will mean savings for you.

Write Dept. AM-455 for catalogs and the name of the nearest distributor.

WS
WENDT-SONIS
Hannibal, Missouri • Rogers, Arkansas

old days when many a foreman carried a hypothetical whip and made his subordinates toe the mark with a vengeance. That type of foreman was accustomed to giving orders with no backtalk, making decisions abruptly without consulting anybody, and snorting fire whenever anything went wrong. The main weakness of the whiplash boss is that he likes to throw his power around too tactlessly.

I once knew a foreman who fancied himself to be an ideal boss. He believed he was scrupulously fair. Once a week he would get out a little black book, walk down the aisles of his shop, and as he passed the various workers, make mysterious notations in his book. He believed that this weekly reckoning kept his men on their toes. This was his way of putting the needle to the men and administering a hypothetical shot in the arm. Actually, the sight of that little black book congealed the men with anxiety and hampered their work. They spoke of this foreman bitterly as their "snoopervisor." The method eventually backfired on the foreman. Not only did the quality and quantity of his outfit's work slip, but morale fell to an all-time low. The Big Boss soon made this foreman realize that being a good supervisor was not just a matter of arbitrarily making workers toe the mark. The foreman was failing to get the best effort out of his workers because of his lack of understanding of one of the basic principles of good foremanship—understanding that his men were as human as anybody else, and if they were treated as persons, they would respond by giving their best.

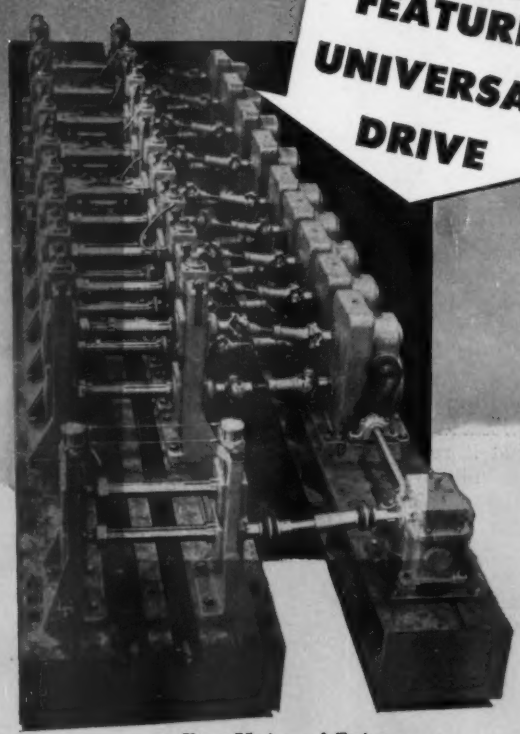
The mature foreman has the means in his own hands to achieve the sort of stimulating that spells high productivity for all workers, and decreased costs in his shop. If he has spotted a few men in his group who are inclined to dog it any time they

". . . Warn the gang I'm going to walk through the shop in a few minutes so I won't get upset seeing them killing time!"

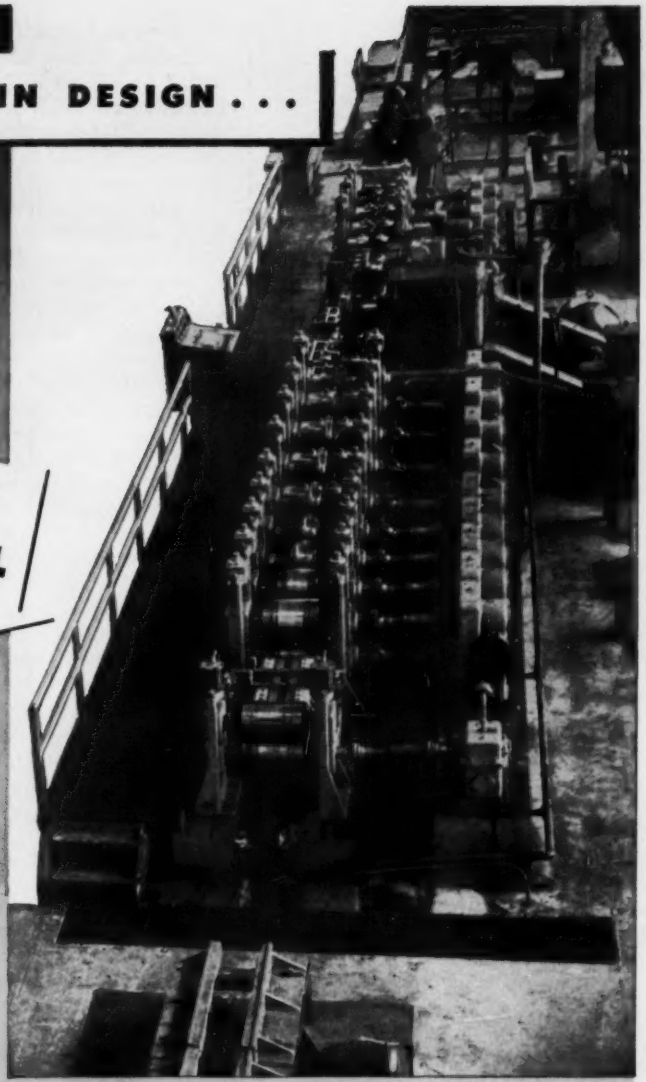
LEADING THE INDUSTRY IN DESIGN . . .

Etna TUBE MILLS

FEATURE UNIVERSAL DRIVE



Etna Universal Drive



You'll notice a trend toward Etna's modern machine design. Etna has sold more Universal Drive Mills than all other manufacturers combined. The Universal Drive provides greater accuracy in the forming of the tube, and allows an easier change from the manufacture of one diameter tube to another.

PERMANENT OIL COOLED TRANSFORMER

For greater efficiency an *Oil Cooled Transformer* is incorporated into the machine. It is a *permanent unit* and *never has to be replaced*. Cooling with oil eliminates the necessity to dry out the transformer after each days work, which is necessary when water is used as a transformer coolant. Etna Mills . . . Built for continuous operation. Write for complete details.

Abbey ETNA Company

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UNITIZED
DUST
CONTROL
eliminates dust at its source!

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DUST CONTROL means each machine has its own custom-tailored dust collector designed to work specifically for *that* machine. There is no guess work, or average suction. Furthermore, dust control is provided only when that machine is running . . . there is no waste of power such as you have with centralized control when only a few machines are operating. This means better dust control at lesser operating cost and less initial installation cost. Get the facts now on how Torit will work better to . . .
"CLEAR THE AIR".

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TORIT
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can get away with it he should take immediate action via personal interviews in his office with those particular workers. It is unnecessary to subject the entire group to stealthy soft-shoe tactics that may alienate the innocent men.

When the foreman discusses the work with the worker, and not in a needling manner, the fact that he is being invited to talk with his boss makes the worker feel that he is considered a distinct individual, a person who has something to say worth listening to. A man often has more and better work in him than he gives. It doesn't mean that he's slacking or that he needs jacking-up. He might even be doing better than standard. But that is not as well as he can do, by a long shot. And this extra effort doesn't come from more pay or better working conditions alone. It's his attitude toward his work, toward the company and the foreman, that decides whether or not he puts everything he's got into his job.

Regarding the argument advanced that the foreman's notebook will prove useful at the time when the men ask for more pay or promotions, it is believed that this is a poor device to use as a basis for personnel decisions because of its lack of objectivity and the fact that it represents the judgment of one individual who may be biased. Today, most firms use merit rating in deciding the relative merits of individual employees. Merit rating removes personal prejudice from decisions on raises and promotions, and removes the individual employee's ability and prospects from the realm of conjecture and places them where they can be studied in an orderly fashion and compared with known or accepted standards. By lessening the mystery and confusion surrounding the basis for promotion and wage increases, the heat and resentment following changes believed to be unfair

"A magnesium lathe! Well, well, what will they think of next?"

PRECISE MULTIPLE CUTTING . . . WITH ONE W&S TOOL cuts your production costs

Holes within holes—holes of multiple diameter, intricate profile, and great precision—can be bored in a single operation with a Woodruff & Stokes small cutting tool designed by specialists for your exact requirements. Holes from pin-point to ½" diameter—single or concentric, tapped or reamed, bottomed or through-cut—are made quickly and economically in the hardest metals with W&S tools.

If your production involves the precision machining of very small holes, let Woodruff & Stokes design into one operation a job that may now be costing you as many as five.

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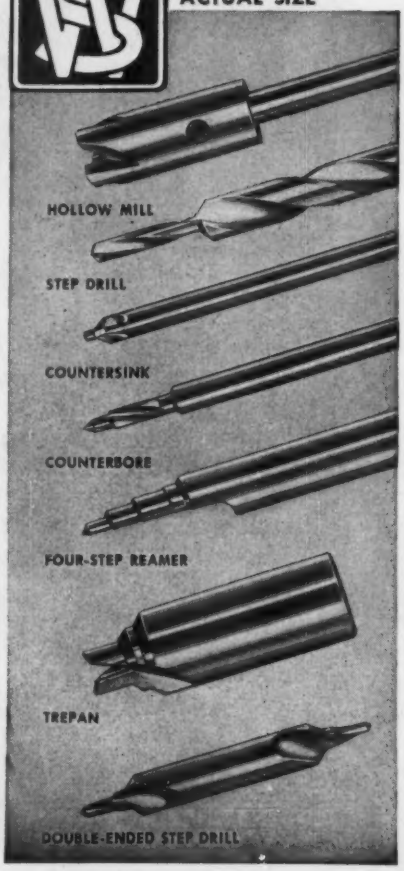
Some W&S Tools
ACTUAL SIZE



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SERIES "A" AIR CYLINDERS

Made in 11 bore sizes from 1½" to 14"...13 standard mountings...many combinations. Extremely close tolerances insure accurate, easy mounting. Steel heads. Cylinders of hard-drawn, high strength brass honed to a satin finish. Piston rods ground and polished then hard chrome plated for extreme smoothness as well as corrosion resistance.

TYPICAL MOUNTING STYLES

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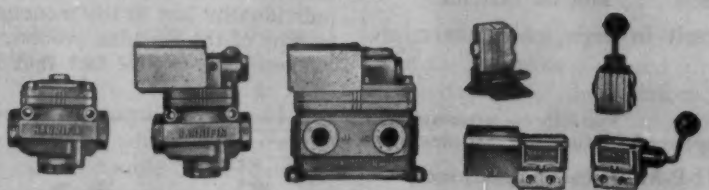
Just off the press. The easiest catalog to use in the cylinder business. Write today.

HANNIFIN AIR CONTROLS

Hannifin has the most complete line of air control valves. Exclusive designs, many types, for hand, foot, cam or solenoid control of air cylinders, presses, and other air-operated equipment. Ask for recommendations.

DISC-TYPE VALVES

Bronze discs lapped to perfect seal with seats. Packless design. For hand, foot or electrical operation.



P-M PILOT-MASTER VALVES

The P-M line provides faster, easier operation for the simplest to the most complicated air-operated circuit. 2-Way, 3-Way and 4-Way Master Valves and Solenoid Pilot-Master Valves...also direct operated 3-Way and 4-Way valves with a wide choice of operating heads.

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The complete air controls catalog! Write for your copy today.

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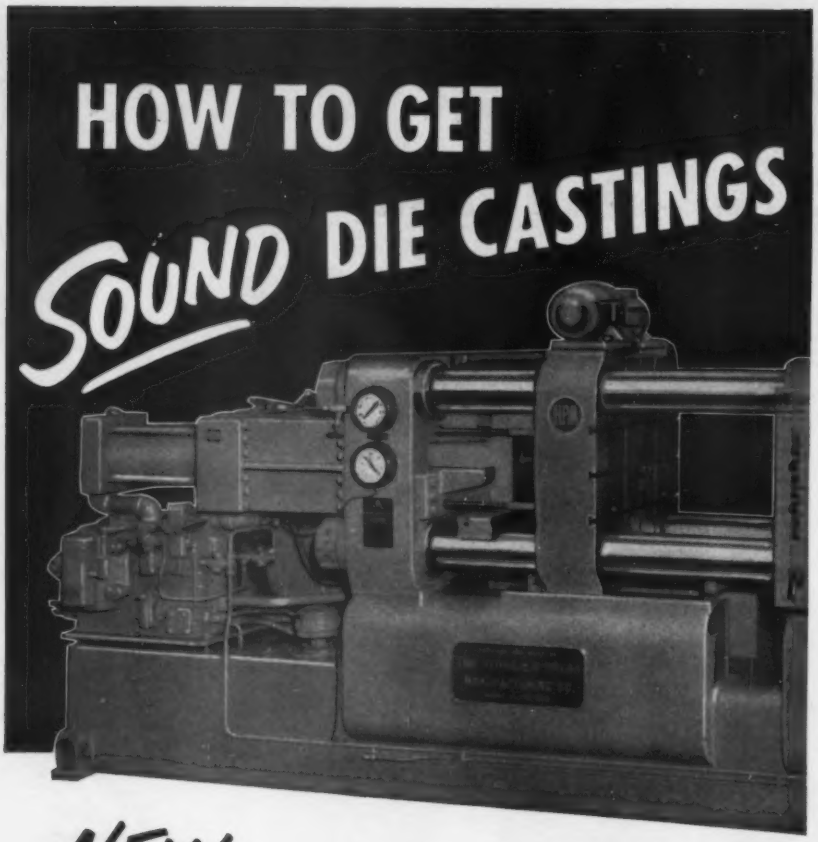
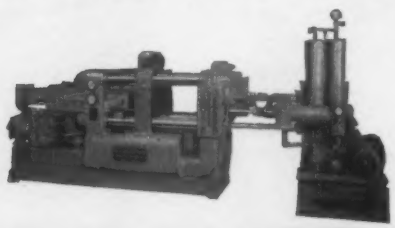


NEW H-P-M Mechanical Clamp Assures Positive Die Locking

Here's why H-P-M's new die casting machine makes better castings: new positive clamping action is achieved by sliding wedges driven by knuckle-joint linkage which preloads the press frame and backs up the platen. The results . . . a minimum of flash . . . sound castings.

In this new H-P-M clamp mechanism there are no toggle pins under heavy shear load . . . no single line contacts . . . and no extremely high stressed members that normally result in high maintenance cost and down time.

These are just a few of the 40 new and improved features of the new H-P-M die casting machine. Write for Bulletin 5400, a completely illustrated story on this H-P-M line of profit makers.



THE HYDRAULIC PRESS MANUFACTURING COMPANY

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HPM

or unjustified can also be reduced. The men whose qualifications are evaluated are assured of a careful review by a group of relatively impartial raters following a prepared and complete plan.

Harry Kaufman
Philadelphia, Pa

•

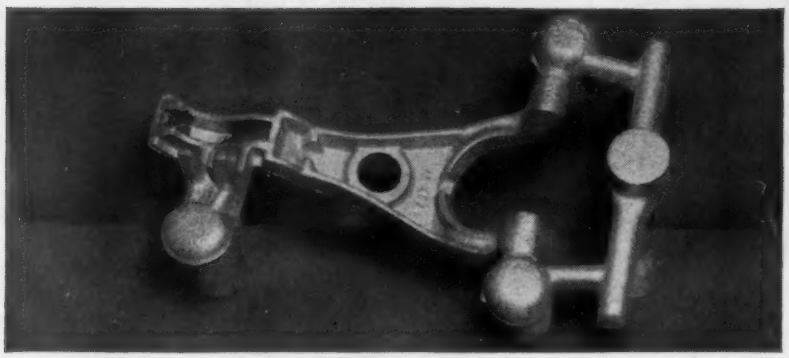
THE MAN AT THE BENCH and the foreman who supervises him both work for the same employer and both contribute their skill and effort toward the same finished product. This does not necessarily imply harmonious cooperation between them. Unfortunately there is great opportunity for conflict in their individual methods of reaching their goals. It is very true it is often necessary for the foreman to take some corrective action to reduce the time the men spend away from their work. However, if he does it in such a manner as to create anger and animosity, he is wrong, because while this action will appear to correct the condition it will definitely not increase the output of work.

There is every reason to believe that the average wage earner desires economic security more than anything else which comes within the wide range of his needs. Being human, the wage earner naturally also wants a congenial and happy relation to his work. This means that he wants a job he likes, one that he can do with the desired degree of efficiency. It also means that he wishes an opportunity to impose himself upon his job, to develop something of his creative ability, and to have something to say about how the work shall be done. The normal workman does not enjoy having his whole individuality lost in the monotonous routine of the machine process.

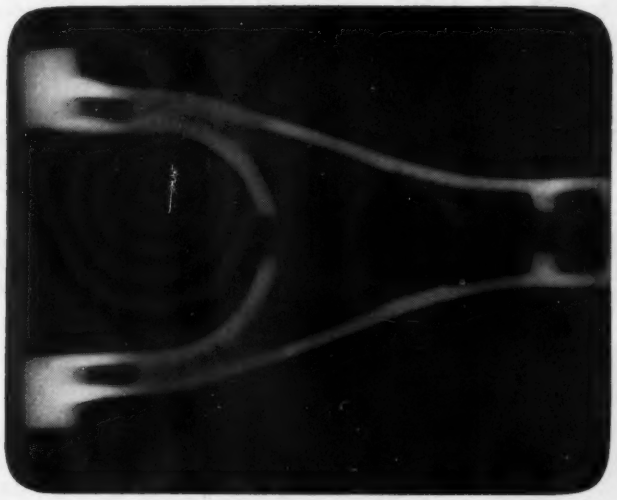
There is a central fact that must

"It's not that we don't appreciate these suggestions, Twigg, but lately you've been avoiding your work."

Shrink steals strength — and profits



— RADIOGRAPHY points the way to avoid it



THIS steel fork lever was designed to take a specific load. Would it hold up? Not if shrinkage had robbed its strength.

But here is where radiography came in with double-barreled effect. First the radiographs which were made showed the foundryman that internal shrinkage was present. Then the radiographs disclosed a recurring pattern of these defects, thus suggesting a change in molding which greatly reduced the difficulty.

This is typical of the ways radiography helps the foundryman make sure only satisfactory work is delivered and so builds a reputation for high-quality castings.

If you'd like to know how it can improve your own operations, talk it over with your x-ray dealer. Or, if you like, write us for a free copy of "Radiography as a Foundry Tool."

EASTMAN KODAK COMPANY, X-RAY DIVISION, ROCHESTER 4, N. Y.

Radiography

— another important example of Photography at Work

Kodak

"But nobody needs aspirin since we started using SUPERDIE!"

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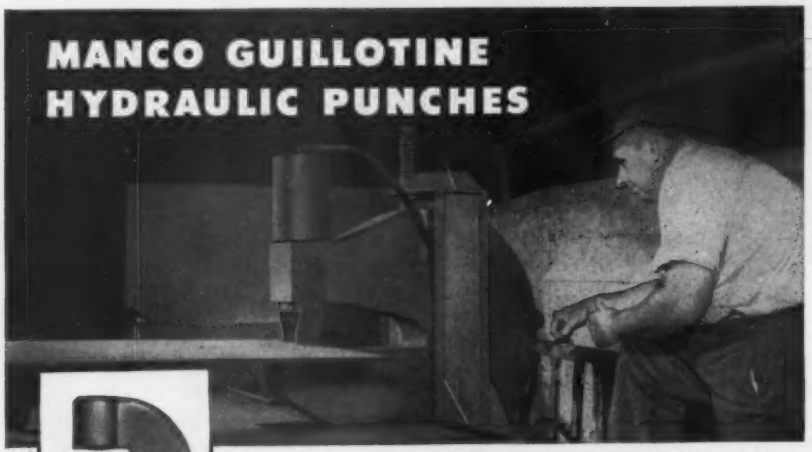
TOOL COLUMBIA STEELS

MANCO GUILLOTINE HYDRAULIC PUNCHES



Model P-20-186

Capacity 1" hole in 3/8" mild steel. Reach 1 1/2". Weight 44 lbs. Available with high-speed electric hydraulic or portable manual pump.

HIGH CAPACITY . . . STRUCTURAL OR FIELD WORK

There is a wide variety of fast, powerful Manco Guillotine Hydraulic punches with varying capacities, available for stationary production use, semi-portable boom-mounting, or complete portability for use in the field. Model P-75-E, above, equipped with Manco high-speed electric hydraulic pump offers 75 tons thrust and capacity for 1" hole in 3/4" steel. Other models up to maximum capacity for punching 3 3/4" hole in 16-gauge sheet.

Write, stating requirements: hole size, location, quantity, accessibility, material punched

Dept. AM-4-B **MANCO MFG. CO.**

Bradley Illinois

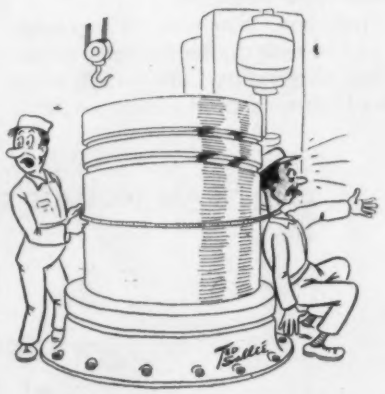
be remembered in any problem of employee-relations and that is that both employer and employee are human beings. As such they are possessed of the usually hidden but ever present potential for desirable and undesirable behavior. Those who manage and those who are managed do not check their psychological equipment at the entrance to the plant. In taking up the daily routine of employment the men do not escape from traits that determine their behavior patterns both inside and outside the shop. This is a simple psychological truth, but it is one that is quite generally forgotten or disregarded by those who are responsible for the administration of human relations in industry.

In present-day industry the genius and talent of thousands of workmen lie hidden and buried because the managers understand so little about the psychology of the worker as to deny opportunity for self-expression and self-assertion. The tendency is to suppress individuality and to encourage or force a spirit of meekness. This loss of initiative and of self-respect are the consequences of extreme mechanization coupled with an administrative policy of suppression. The leadership should be so tempered and so directed as to instill into the men a spirit of willingness and cooperation and an understanding of the necessity of turning out the work.

Robert Weidenhoft
Brooklyn, NY

•

UNFORTUNATELY, Ed doesn't remember all the details of the situation from the days when he was on the bench. It may be very true that the glassy stare of his foreman sent him scurrying back to his work, but with what kind of an attitude? He was



"Somebody figured wrong! This is supposed to be seven inches smaller!"

always

five years

ahead of

the times

whatever

the

need

might

be

1920

1925

1930

1935

1940

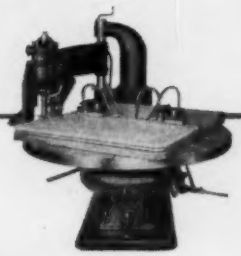
1945

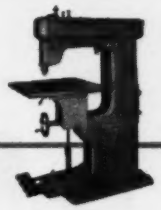
1950

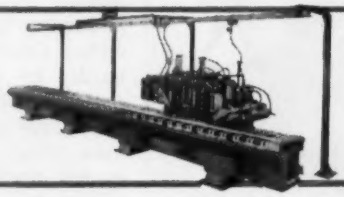
1955

1960

1965





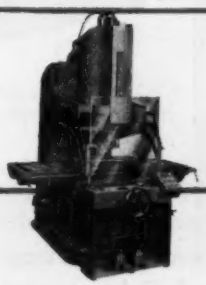


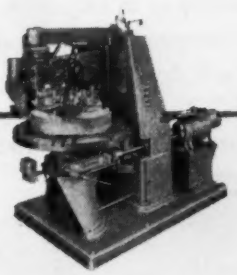
Go back through the years or view the machines of the present . . . and always Onsrud has been a little ahead of the times. Early Onsrud woodworking machines, for example, were well ahead of their day when designed with air turbine motor drives. Cutter speeds jumped from 2,000 to 20,000 RPM and old concepts tumbled as production soared. The Onsrud Spar Mill, first developed with Lockheed in the late 1930's, did the "impossible" job of milling an eleven foot spar beam in one machine set-up. It also increased production by about 18,000%.

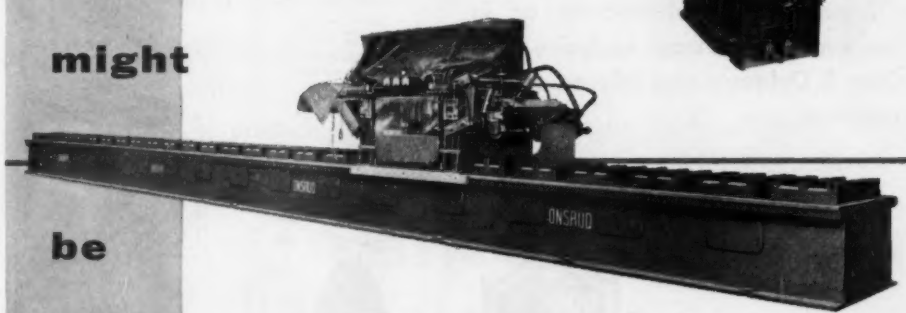
Today's Onsrud machines for aluminum milling and woodworking are just as much ahead of their time. Today's super Spar Mills with 100 HP milling heads and with beds up to 80 feet in length, mill huge aluminum forgings and extrusions. Onsrud profile milling machines with patented InvOmil heads reproduce any desired contour in aluminum plate up to two inches thick. And Onsrud Automatic Shapers turn out accurately formed wood parts by the hundreds where only dozens were made before.

These and many other advanced Onsrud machines are at your service to give you new and better ways of increasing production and lowering costs. At any time, your inquiry is cordially invited.

ONSRUD MACHINE WORKS, INC.
3921 Palmer Street • Chicago 47, Illinois







Onsrud ...FOR DOING THINGS *BETTER* BY DOING THINGS *DIFFERENTLY*

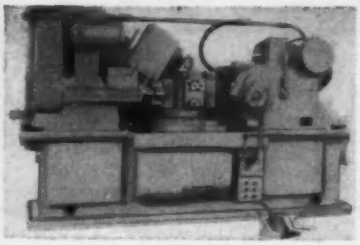
Super high speed machines for milling aluminum and other non-ferrous metals . . . and for woodworking routing and shaping.

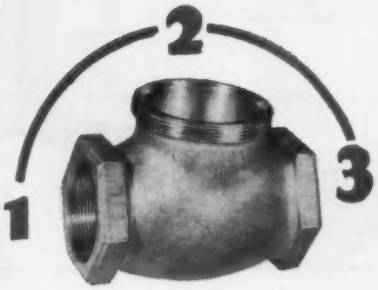
Here's what is meant by

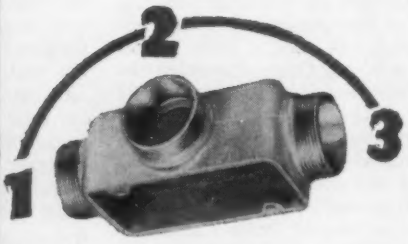
"1·2·3"

in the

GOSS & DE LEEUW AUTOMATIC CHUCKING MACHINE







The outstanding advantage of this machine is ability to handle operations on one, two or three ends of a piece simultaneously or in sequence, *without changing set-up or rehandling.* It is the only standard machine that will do this.

"1-2-3" means ability to handle work requiring machining operations on one, two or three ends simultaneously or in sequence—a method exclusive with Goss & DeLeeuw and offered on this machine.

For complete details ask for illustrated bulletin. Send samples of your work for time and cost estimates.

GOSS & DeLEEUW
QUALITY PRODUCT-QUANTITY

GOSS and DE LEEUW

MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

back at this bench and supposedly working so that it looked good for the foreman in case someone from the front office came through the shop. A foreman who takes this attitude is near-sighted and is making things look good for himself without regard to whether or not it is for the ultimate good of the company.

True, it is the duty of the foreman to get the work out at a minimum cost, but there are people in this situation and therefore the situation is a psychological one, as well as an economic one. Because the lot of the worker and of management is economically hard does not mean that either side is justified in making it harder by failure to consider that each member of the organization, on whichever side he may be, is a human being and as such is governed by his emotions.

Of what value to the company is an action on the part of the foreman that sends the man back to the bench angry? Here is the company on the one hand making every effort in a material way to get the best machines they can afford to buy, and making every effort to use the correct tools, and to operate the machines at the best speeds, while on the other hand they are cutting into production by neglecting the psychological factors which affect the men running the machines.

It is very desirable to arouse and maintain in the worker, whatever the level of his activities, an interest in his work. We must define and adjust the responsibilities, duties, rights, and privileges so that each knows where he stands, what is expected of him and what he is justified in expecting in return. All too often there is a no man's land around a job, a fringe of doubtful territory in which most of the acts calling for disciplinary measures and dissatis-

"They really should do something about the crowded conditions in the place."

"Silica in die castings was shortening tool life"

Because of the silica content in zinc aluminum alloy die castings, a well known midwestern manufacturing company had the problem of shortened tool life. During a routine call, Sinclair Lubrication Engineer K. W. Cross learned of this difficulty in machining.

"After studying the problem I recommended Sinclair CADET® OIL 'Z' in place of the competitive cutting oil being used," Mr. Cross reports. "I was certain that its low viscosity, excellent wetting quality and ability to flow into deep holes to be threaded, would provide greater cooling and *longer tool life*.

"A test of Sinclair CADET OIL 'Z' proved I was right," Mr. Cross continued. "Moreover, due to the low viscosity of the oil, the machined parts had practically no carry-off, and consequently *oil consumption was reduced*. This company is now using Sinclair CADET OIL 'Z' for all machining of castings."

SINCLAIR LUBRICANTS

Why not give a Sinclair Lubrication Engineer the chance to help solve *your* cutting and lubrication problems? There's no obligation. Call your Sinclair Representative or write Sinclair Refining Company, Lubricating Sales Department, 600 Fifth Avenue, New York 20, N. Y.

Stocks

Ample stocks of Simonds Products . . . Saws, Machine Knives, Files, Die Steel, etc. . . . for cutting wood, metal and other materials . . . are maintained by your *Simonds Industrial Supply Distributor* as a "private bank" on which you can draw any time of the day or night.

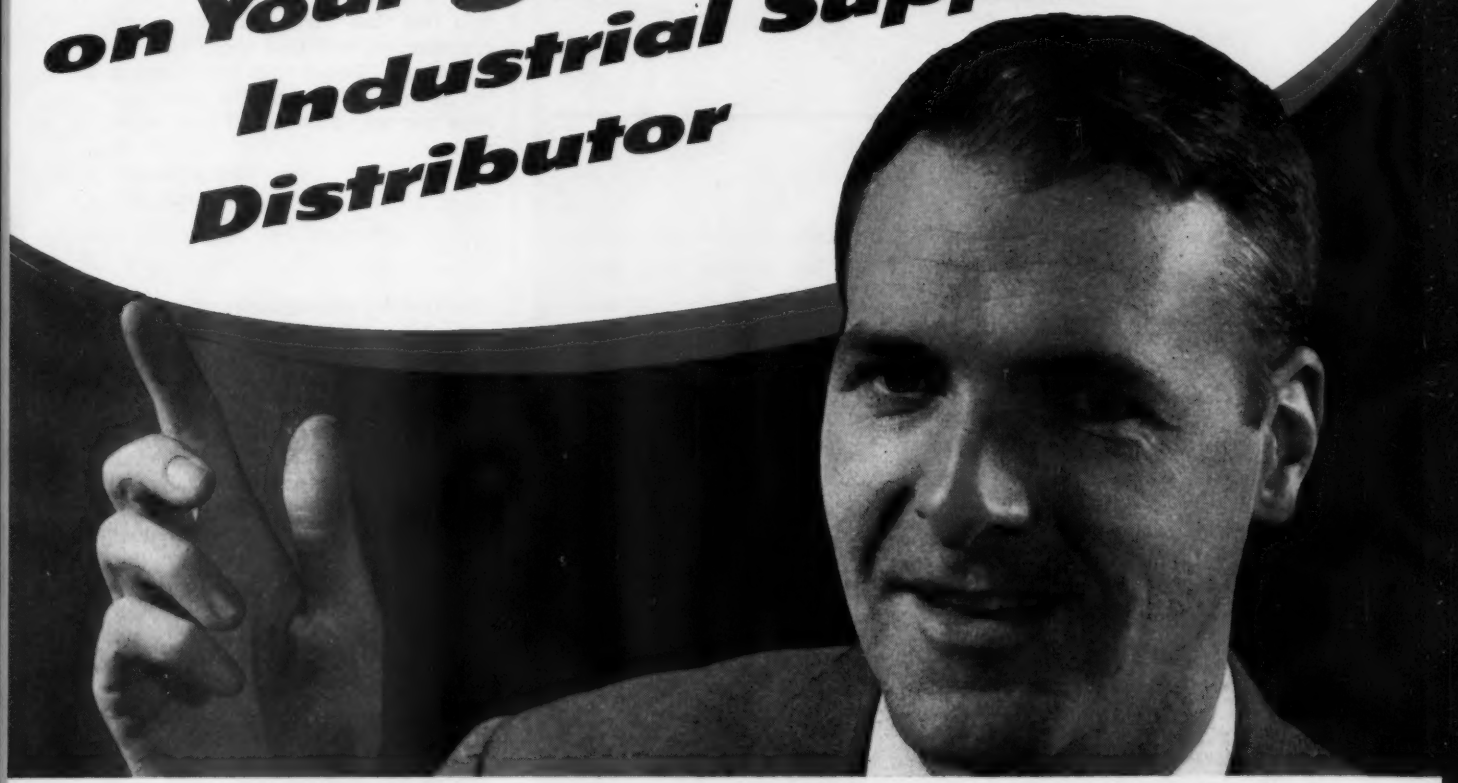
Service

This is truly the middle name of your Simonds Industrial Supply Distributor. And it includes everything he and his organization can do to improve the efficiency of *your* operation and keep it running without slowdown or shutdown.

Speed

In all things . . . delivery, service, availability for any reason whenever you want him, your Simonds Industrial Supply Distributor may be depended on to "get there fastest with the mostest" of whatever it is you need.

For Real SSS Service You Can Always Depend on Your SIMONDS Industrial Supply Distributor



On the facing page you have the three chief advantages of dealing daily with your Simonds Industrial Supply Distributor. And there are other important advantages, too, such as these:

One source, one transaction, one bill for all your needs in wood and metal cutting tools. And of course his thorough practical knowledge of cutting tool application and performance . . . which is your assurance that you'll get the best results out of the finest saws, files and machine knives made today . . . the Simonds red-trademarked line that is completely controlled for quality, from Simonds' own tool steel mill to Simonds famous windowless factory.

So we say, when you want or need service, "Call your Simonds Industrial Supply Distributor."

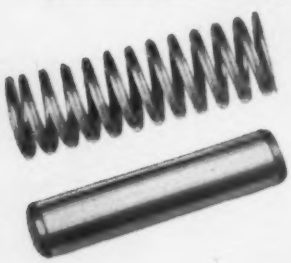
For Fast Service from Complete Stocks

Call your SIMONDS Industrial Supply DISTRIBUTOR

SIMONDS SAW AND STEEL CO.
FITCHBURG, MASS.

Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon. Canadian Factory in Montreal, Que. Simonds Divisions: Simonds Steel Mill, Lockport, N. Y. Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada

A die is no better than its die set



PRECISION-BUILT ACCESSORIES

In stock for immediate delivery is an extensive range of die-makers' accessories, including the new self-oiling guide pin bushings.

The big advantage of a *full-value* Detroit Die Set is that you get what you specify... factory-tested to assure you exact thickness of die holder and punch holder, true parallelism and squareness of surfaces, precision fit of pins and bushings. This means not only the accurate die set you expect, but also faster mounting, less maintenance, longer life. Reworking a die set in your shop can cost many times the difference between a "bargain" die set and a *full-value* Detroit Die Set.

And, remember, our stock die sets are shipped within 24 hours; specials in remarkably short time.

Detroit DIE SET CORPORATION

2895 W. GRAND BOULEVARD • DETROIT 2, MICHIGAN

Offices in Principal Industrial Centers

faction are committed. Clearing up these items is one factor making for greater confidence and a more solid feeling of security without which no group of workers gives its best efforts to the work at hand.

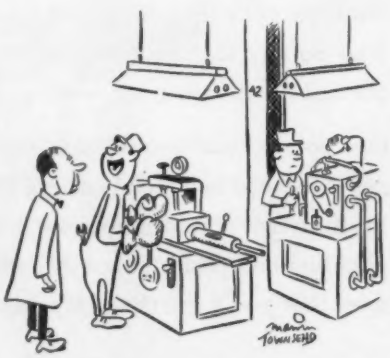
Few supervisors realize the universality of the need we all have for appreciation of our work. A judicious word of praise is easy to bestow and produces results out of all proportion to its real significance. No one wants to be merely a gear in a machine. The enlightened foreman will not take the negative approach and walk around the shop taking notes of who is working and who is not. He will take the positive approach and encourage the workers so they will feel that they are part of the organization and that their work is important. Under this environment the problem of having the men take time out will be reduced to a minimum.

Henry George
Bronx, NY

•

CIRCULATING among the men, observing what is going on and taking notes of job progress is no more than a periodic checkup any clear-thinking business man would do. It does have its drawbacks as well as advantages however, particularly the effect it has on the men psychologically. It is one of the most potent shots in the arm any foreman can use if done with quietness and tact.

There is one thing certain,—if the men think that their foreman is on his toes, and makes a habit of checking up on things, they will likewise tend to get on their own piggies and stay on them. It is obvious that the workers will attend strictly to business if they know that they are being properly supervised. You can't blame anyone who lets up on his job if he knows that the one paid to su-



"Gregory and I have a bet who can get the closest tolerance — and I'm giving him a handicap."

Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon. Canadian Factory in Montreal, Que. Simonds Divisions: Simonds Steel Mill, Lockport, N. Y. Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada

7 benefits received by switch to STANOSTAMP *Compound C*

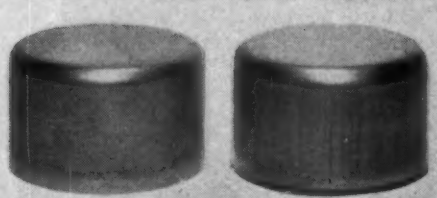
Jagemann Stamping Company, Manitowoc, Wisconsin, benefited seven ways by switching to STANOSTAMP Compound C. Finished ferrules drawn from 19 gauge cold roll steel were being badly scored. At the same time dies were being scratched and excessive heat experienced in the press. Standard Oil lubrication specialist R. E. O'Brien suggested STANOSTAMP. The result:

1. Production increased 20%
2. Die maintenance reduced 30%
3. Spoilage reduced
4. Finish improved
5. Galling minimized
6. Cooler machine operation
7. Washability improved

The results add up to this: There is a combination in the field of industrial lubrication that is hard to beat. It is (1) Standard Oil lubrication specialists capable of giving technical help and (2) Top quality products *that deliver results.*

STANOSTAMP Compound C is a water emulsifiable paste for heavy drawing operations. It contains an inert, non-abrasive mineral filler for protection of dies and work, is readily cleaned from work in conventional washing equipment. In the Midwest, your nearby Standard Oil lubrication specialist will be glad to tell you more about STANOSTAMP. Call him. Or contact: Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

Father and son inspect ferrules. William P. Jagemann (left), President, and son William T. Jagemann note improved finish on work produced using STANOSTAMP.



Air hose ferrules. One at right produced before switch to STANOSTAMP, one at left produced after conversion to this forming compound. Scoring of dies as well as work occurred before switch.

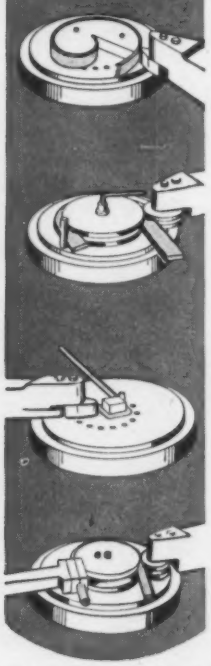
STANDARD OIL COMPANY
(Indiana)

STANDARD

"it's easy to bend"

a new 32 Page BENDING MANUAL

by the originators of "Die-less Duplicating"



This instructive and authoritative booklet will quickly prove itself indispensable wherever bending is done or is needed. It brings you a veritable gold mine of tested authentic bending methods applicable to any rotary type bender. The proper bending technique may frequently offer a new approach to an old problem by simplifying product design and cutting production costs.

The exact methods of producing various types of bends in a wide range of materials are illustrated, step by step, with over 90 diagrams and charts together with valuable tooling suggestions.

You'll want a copy . . .

Mail your request today.

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PLEASE SEND 32-PAGE BENDING MANUAL

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City_____ State_____

pervise him is laying down on his job.

I know of at least two executives who resorted to this checking-up stunt. One of them was open and above-board as he made his way around with his information pad, soliciting ideas and information from his men and jotting down any facts which might be of value in the present or the future. The other gentleman made it a point of going about the shop with one thing in mind—that of taking mental notes of what he observed. He would then go to his office while the information was fresh and make notes which he would mull over in his few off-stress moments. The purpose was the same, with the exception that the former acted as a definite shot in the arm for some of the men who, no doubt, needed such treatment.

It is only natural to think that the foreman may create a little resentment or opposition among some of his men; there'll be those who look upon him as a snooper, but you'll find that the greater percentage of workers will be broadminded enough to know that a supervisor must keep his eyes on things if he is to have any control over them. They know that the purpose of the shop is to turn out work and that it is up to the boss to do whatever he can to bring production up to his highest state of efficiency.

We've got to face the truth. We do have more than our share of grown men who act like immature kids. How the boss is going to cope with such practice is something that he will have to work out in his own way. Calling them on the carpet now and then may do wonders, and if that fails, there is always the chute to fall back on. One of the most effective means at his command is to call the men together occasionally and give them a good, heart-to-heart talk about the unnecessary cost caused by actions which are contrary to making the most of their time. He doesn't need to mention unnecessary talking or horsing around; if the men have any brains at all they will tumble as to what he means.

Fortunately, men as a general rule do attend strictly to business and are aware of the value of time. It is the annoying few that Ed is trying to search out. I don't think he needs to fear that there will be general disapproval of his method of going after that which is right. Workers in general are able to evaluate time and are inclined to oppose those who are in the habit of wasting it.

Lawson Kinsley
Pottsville, Pa

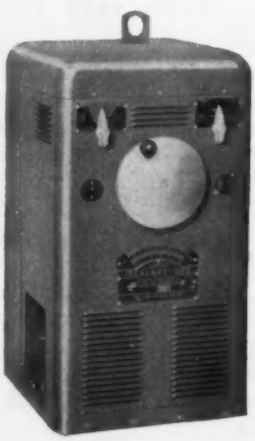
BOTH AC and DC WELDING CURRENT FROM ONE WELDER

New Lincoln Idealarc has soft arc and forceful arc with arc-booster starting on both AC and DC

With Lincoln's new Idealarc welder, you have complete freedom of choice in selecting the best type of arc for any job. You can choose AC or DC, whichever gives the best results. Then you can select a soft arc or forceful arc depending on position, type of electrode and weld appearance.

For the first time, shops that do not have 3 phase power can now use DC welding. Idealarc operates from single phase power.

Arc-booster starting is provided on DC as well as AC. This assures non-sticking operation, easier intermittent welding, complete penetration at the start of each weld.



LINCOLN IDEALARC
In One Machine—AC and DC
Soft arc and forceful arc in *both* AC and DC
Arc Booster Starting in both AC and DC

SEND FOR BULLETIN 1343 ON LINCOLN IDEALARC Write:

THE LINCOLN ELECTRIC COMPANY
Dept. 2002
Cleveland 17, Ohio
THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

TUTHILL PUMP COMPANY EXPERIENCES...

"NO FAILURES

SINCE USING

SAVES MONEY, TOO!"

● Tuthill knows the rotor is the heart of their pump. Quality cannot be compromised. For more than 10 years, Tuthill has used STRESSPROOF for rotors (replacing heat-treated alloy steel) without a failure!

Strength is required in these rotors to transmit the power through the shaft to the idler gear. Extremely high operating speeds mean the rotors must be straight. Wearability is an absolute necessity if the rotors are to stand up under severe operating conditions.

STRESSPROOF has all of these qualities. In addition, it is readily machinable. Its in-the-bar strength eliminates heat treating with its distortion, cleaning and subsequent machining problems. No rough machining, heat treating and finish machining with STRESSPROOF. The rotors are finish-machined from the bar.

STRESSPROOF's minimum warpage eliminates all straightening operations in this case. Its wearability keeps the rotor running year after year. It also provides real savings in both material and manufacturing costs.

STRESSPROOF makes a better part at a lower cost.

Tuthill Model L Series mechanically sealed pumps are used in lubricating, hydraulic, transfer and burning oil service. Capacities range from ⅓ to 6 g.p.m. at pressures up to 600 p.s.i. The rotors for these dependable industrial pumps are made from La Salle STRESSPROOF.

WRITE TODAY FOR

helpful data bulletin No. 15... "Improve Quality — Cut Costs"

AVAILABLE FROM LEADING STEEL DISTRIBUTORS COAST-TO-COAST

La Salle STEEL CO.

1416 150th Street, Hammond, Indiana

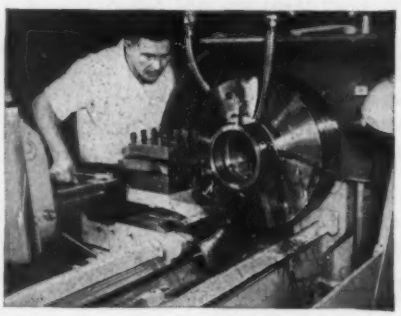
MANUFACTURERS OF AMERICA'S MOST COMPLETE LINE OF QUALITY COLD-FINISHED STEEL BARS

W+B
INDUSTRIAL LUBRICANTS

For 67 Years LUBRICATION ONLY

Out of the W & B labs have streamed a long succession of lubrication specialties: transparent grinding coolants . . . paste-form and fluid-type water solubles . . . concentrated bases to blend and fortify metalworking lubricants . . . oils for critical grinding, honing . . . and dozens of others. You see, for over half a century W & B has stuck to its own particular last — designing lubricants that keep production up, machining costs down. Successfully, too. Ask any top machine operator.

Take W & B Grinding Concentrate 1500. This transparent water-soluble lubricant for grinding ferrous metals and titanium is used as thin as 200 to 1. Yet it keeps grinding wheels unusually open, settles chips almost instantly, stays virtually foam-free.



Do *you* have a lubrication headache? Ask us, without obligation, to send a W & B Lubrication Expert into your plant to consult with you.

THE WHITE & BAGLEY CO.

Established 1888

Worcester Detroit

IF ED HAS A SHORT memory, taking notes is not a waste of time, provided he does not go to ridiculous lengths. Few competent foremen require written notes to enable them to separate, in their minds, the sheep from the goats in the matter of behaviour or ability.

If written notes *are* necessary, they need not be taken in an offensive or provocative manner. Flaunting such an activity in the faces of the men is simply to ask for trouble, and is not the hallmark of the successful administrator. I would compare the whole idea to the building up of a pressure of indignation, resulting ultimately in a boiling over and a lambasting show-down, from which none of the participants gain any satisfaction.

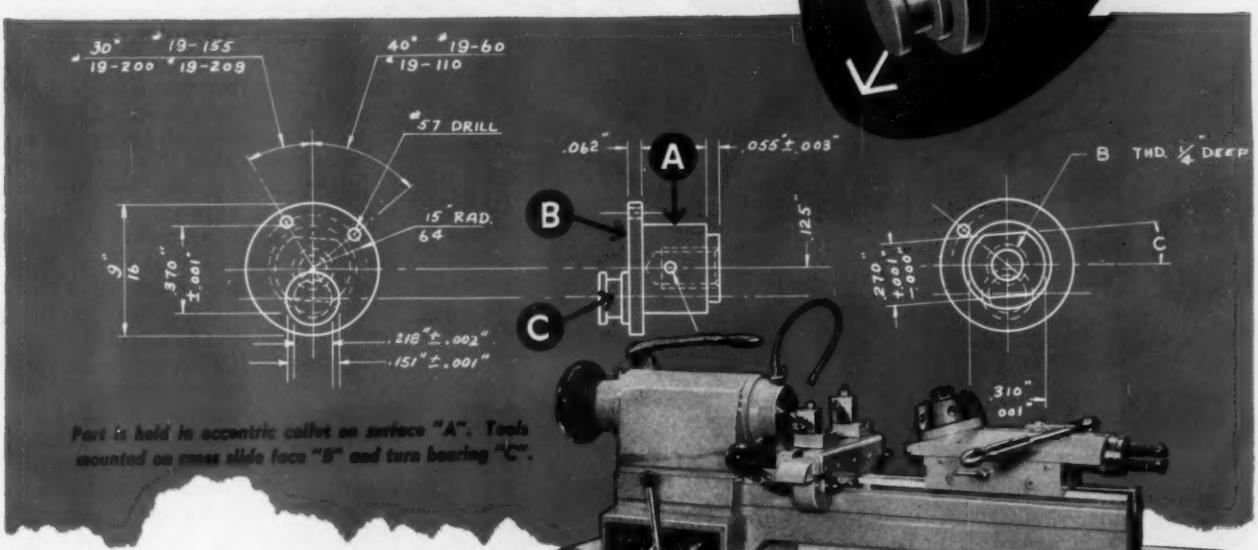
To my mind, a better plan is to deal with each incident as it arises and so keep the situation from getting out of hand. Were this line taken by Ed, he would have no need for notes and no backlog of offences to, perhaps, explosively work off.

Ed seems to cherish the delusion that if the men see him taking notes on their weakness for gossip, they will be scared into mending their ways. Nothing could be further from the truth. Work is too plentiful today and skilled men too few in number for that short-sighted and currently discredited method to succeed. Men, today, are not so readily scared. They can be led; they won't be driven. For Ed to suggest that "this little note-book will help by giving me a better idea than I usually have of who deserves a raise" is surely a confession of failure. That information should be sticking out a mile in his mind. It is not to be gained by way of written notes.

Few things infuriate the men more than police methods of supervision. The shop foreman who favors such method is always, and deservedly, highly unpopular with the management and men. They are an excellent device for killing initiative and limiting the intensity of the productive effort. Ed's attitude here is all wrong when he admits his notebook is intended to scare the men into producing more. He says he wants to see if a little closer supervision will result in greater production. He ought to know that any really close supervision will reduce avoidable loss of production time, but the quality of the close supervision will determine whether *increased* production will result, which, of course, is not quite the same thing.

C Donald Mackinnon
Glasgow, Scotland

INSTANT start-stop boosts Penn Fishing Tackle parts to 250 per hour!



Penn Fishing Tackle Mfg. Co. practices what it preaches. Its officials went fishing recently —to catch some ideas for stepping up production on several eccentric parts. Investigation of the Rivett 918 "Steelway" Cabinet Turret Lathe revealed that machine with its production drive was ideally suited to their requirements.

This production drive features "split-second" starting and stopping of the lathe spindle by movement of the lever chuck closer handle. With one forward pull, the operator closes the collet on the work, releases the brake and engages the spindle drive. When the lever is pushed back, the spindle drive is disengaged, the brake mechanism is applied and the work is released.

Installation of the 918 "Steelway" turret proved immediately successful. Production of troublesome parts was boosted two-fold. A 918 "Steelway" can boost your production, too! Why not go fishing and see what savings can be caught!

Model 918 "Steelway" Cabinet Turret Lathe.

← *Insert shows production drive:* Motor runs continuously regardless of number of times spindle is started and stopped, thus eliminating overheating of motor.

RIVETT

RIVETT LATHE & GRINDER, INC., DEPT. AMR 4, BRIGHTON 35, BOSTON, MASS.

PEARLITIC MALLEABLE CASTINGS

when operating conditions . . .

. . . are severe

If service conditions are unusually rugged and you're troubled by high manufacturing costs—look to pearlitic malleable castings!

Pearlitic malleable has high fluidity that casts easily into complicated shapes. It resists wear under heavy loads at high speeds . . . has high ultimate strength . . . possesses excellent non-seizing properties for bearing surfaces . . . can be given a very smooth finish where desired . . . and can be either liquid quenched or air quenched. And perhaps *most important of all, pearlitic malleable machinability index ranges from 80 to 90* (B1112 steel = 100).

So look your product over critically. Then check pearlitic malleable castings. They can replace more expensive methods of fabrication or manufacture . . . can lead to reduced weight, less machining time . . . fewer assembly operations . . . *greater sales appeal for your product.* AA-166

NATIONAL MALLEABLE AND STEEL CASTINGS COMPANY
Cleveland 6, Ohio

The Nation's largest independent producer of malleable and pearlitic malleable

SPOT DEMOTION

Should the foreman explain to a worker his reasons for shifting him from one machine or job to another? Will such an explanation eliminate misunderstanding and resentment, or is it unnecessary?

WHY IS IT that after a man gets his foot in on a job, so to speak, he is inclined to want to run the place? This refers to the man who has become imbedded on the job, Browning, who thought that he was the only guy who could be entrusted with the jig borer. I have in mind another fellow who spent his hours with the small planer but it so happened that this chap was a wizard at setting up freak jobs and his attitude wasn't that of an indispensable man. He was a good hand and made no bones about it, and took the attitude that if anybody came along who thought he was better than he, then he could have the job. This fellow was steady at his work and lost very little time; he was one that the foreman could depend on in every sense of the word.

There are times when it is advisable to have a certain man operate a machine—especially such a valuable machine as a jig borer. Here is a tool built for accuracy and it is a certainty that such a machine should not be left in the charge of a lunkhead.

We've all come across the "go-getter" in our time, and run for cover when he gets into action. A go-getter has no place running a machine built to do precision work. It may be that Ed has discovered that Browning is of this type and finds it necessary to replace him with another worker of more gentle temperament. Ed should, if he already hasn't done so, inform the fellow why he is taking him off the machine. It may be that a good talk to the man will enable him to remedy his careless tactics.

There may be another reason why Ed wishes to do some shifting around. The chap might be a very good worker, turns out his work satisfactorily in quality and time, yet the machine, being an instrument of great precision, makes him feel cocky. Ed has probably heard through some trusted worker that the fellow has been talking around about how the shop would get in the hole if he were to quit. Naturally Ed would resent such an attitude and loses no time in showing the conceited ass who is running the shop.

I see no reason why Ed shouldn't

when it comes to AUTOMATION

This eight station multiple spindle dual loading Transfer Type Machine uses an air-hydraulic transfer mechanism. Various drilling and tapping operations are performed on cast iron carburetor throttle bodies at the rate of 450 per hour at 100% efficiency. Parts are located and clamped automatically in previously machined butterfly valve holes at each station. Parts ride free on rails between work stations. New brochure shows why, when it comes to automation . . . it pays to come to . . .

HARTFORD *Special*

THE HARTFORD SPECIAL MACHINERY CO. • HARTFORD 12, CONN.

UM56P
13" Swing Lathe
34" Between Centers
Rapid Shifting "U" Drive

Sheldon's larger, wider "Zero Inspection", Tapered Roller Spindle Bearings save you money by making these lathes better in 6 ways.

1st They *meet* Sheldon's high standard for accuracy—each bearing has a run out limited to .00015".

2nd They absorb thrust and radial loads beyond requirements—basic rating on front bearing at 500 R.P.M.
for radial loads .....3540 lbs.
thrust loads .....2335 lbs.

3rd They *end* costly bearing maintenance—require only a fractional turn of bearing take-up after long periods of service.

4th They *hold* the spindle in rigid alignment while permitting it to turn freely at high or low speeds—the line contact between rolls and races, and the opposing taper design, preclude lateral movement or end play.

5th They *minimize* friction—smooth mirror finished rollers and races running in light oil, deliver more horsepower at the Spindle Nose and lower power costs.

6th They *increase* work capacity. Larger than similar type bearings on other lathes in this price range, these bearings make it possible to turn out *more work* and *better* work at lower costs.

Write for G-55 catalog showing new 10" 11" and 13" swing, bench, cabinet and pedestal mounted Sheldon Precision lathes.

SHELDON MACHINE CO., INC.
4234 NORTH KNOX AVE. • CHICAGO 41, ILLINOIS

tell the party just why he was taken off the machine and by so doing the fellow might learn a lesson which may govern his conduct in the future. It is very hard for some people to take any kind of defeat. Instead of taking it on the chin like a man they have to whine about how badly they are being treated. Instead of asking point blank just why he was taken off the machine the guy had to peddle it around to the other fellows that he was unjustly dealt with.

The fact of the matter is that the foreman is responsible for production and it is up to him to make any changes around his shop which will bring it up to its highest efficiency. He can't let sentiment or fear of criticism govern his actions. There's a job to be done and he should see to it that it is going to be done the way he planned it. Ed evidently feels that by breaking down dependence he is working toward this end. By keeping a man on one machine he weakens his own control over that machine whereas by moving the men around he can determine which one is better in a certain situation.

Anyone who is responsible for production has no time to humor grown-up babies who bellyache about every move the man has to make. He's there to get the stuff out in the shortest time possible or else.

Arthur Harman
Wissahickon, Pa

•

WE CANNOT RUN ROUGH-SHOD over the feelings of employees without causing resentment. It takes very little time for the foreman or supervisor to explain the reason for the change. This should be done even when it affects the employee only indirectly. It is extremely important for those who lead others to know and practice this method as a means of influencing others.

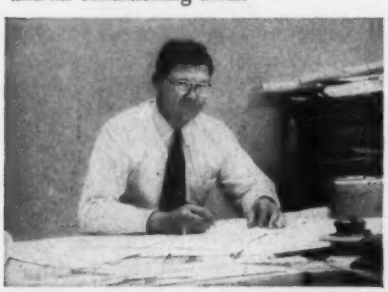
I don't think any one of us likes changes we are not notified about. It has been my experience that to get a good job done, let the other fellow feel he is a part of it. In this case the employee was moved to another job. No reason was given for the change and the employee resented it. Because of this resentment he complained to other employees. He was wasting their time as well as his own.

He was not producing either mentally or physically. In this case the supervisor was the enforcer, not a leader. A little tact on the supervisor's part and there wouldn't have been a problem.

A E Salmons
Philadelphia, Pa

Rush Stamping Company gives stamp of approval to Cities Service

Some of Rush's Stampings awaiting shipment. The rapidly growing, 4½ year old firm makes parts for auto hot water heaters, brake levers, vacuum cleaners, and air conditioning units.



Chief Engineer Fred W. Selter switched to Cities Service drawing oil a year ago. He praises it for eliminating need for many compounds, preventing build-up on dies, and lowering costs.

Praises Cities Service drawing oil as timesaver, worksaver, moneysaver.

The four and a half year old Rush Stamping Company of Toledo, Ohio, has already grown into a sizeable operation. Producing stampings for air conditioning units, vacuum cleaners and automotive parts, the company utilizes 41 punch presses ranging from 35 to 400 tons in pressure.

Like many other stamping companies, Rush was using a variety of paste type compounds for its drawing operations and suffering the penalty of heavy costs and build-up on dies which such compounds inflict. Then, a year ago, they switched to Cities Service drawing oil.

Here are the results in the words of F. W. Selter, Chief Engineer: "Now one Cities Service Oil does our variety of jobs, completely eliminating previous number of products and compounds required. This oil prevents build-up on dies formerly created by our paste type compounds, and in some applications saves as much as 50% in costs over these compounds. In addition, Cities Service has eliminated supply problems by offering us local warehousing and engineering services."

Learn more about Cities Service drawing oils which have already received the stamp of approval from so many firms. Talk with a Cities Service Lubrication Engineer. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

I've been making tools for wire and ribbon metal forms long enough to know that A. H. Nilson Fourslides are the most adaptable and produce parts most economically. For easy set-up and tool adjustment, accurate feed, and rugged design . . . Nilson Fourslides are my choice.

Look at the part shown on the left . . . made in our Nilson #S-O Fourslide. Better than 5,000 of these are produced per hour *automatically* from coiled stock using .039 dia. tin-plated copper wire, and this tops any previous production method.

I'd suggest you contact Nilson yourself and learn how you can increase production and lower costs with Nilson automatic Fourslides.

Actual Size

A.H. NILSON MACHINE COMPANY

1519 RAILROAD AVENUE, BRIDGEPORT 5, CONNECTICUT

Automatic Chain Making Machines : Staple Forming Machines : Wire and Stock Reels : Wire Straightening Equipment : Slide Feeds for Presses

New Books...

DIRECTORY OF COMMERCIAL AND COLLEGE TESTING LABORATORIES—*Published by American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa. Price $1.00.*

This new publication is the latest revision of Publication M187, *Directory of Commercial and College Laboratories,* formerly published by the National Bureau of Standards, but now discontinued in favor of this later work. By mutual agreement, all future preparation and publication of this directory will be handled by ASTM.

The book gives information as to the location of testing laboratories, and the types of commodities and nature of investigations they are prepared to undertake. It will prove a useful reference work for companies needing testing-laboratory services in the evaluation of raw materials and finished products, as well as to those who are not equipped to make their own acceptance tests and have therefore hesitated to buy on specifications.

•

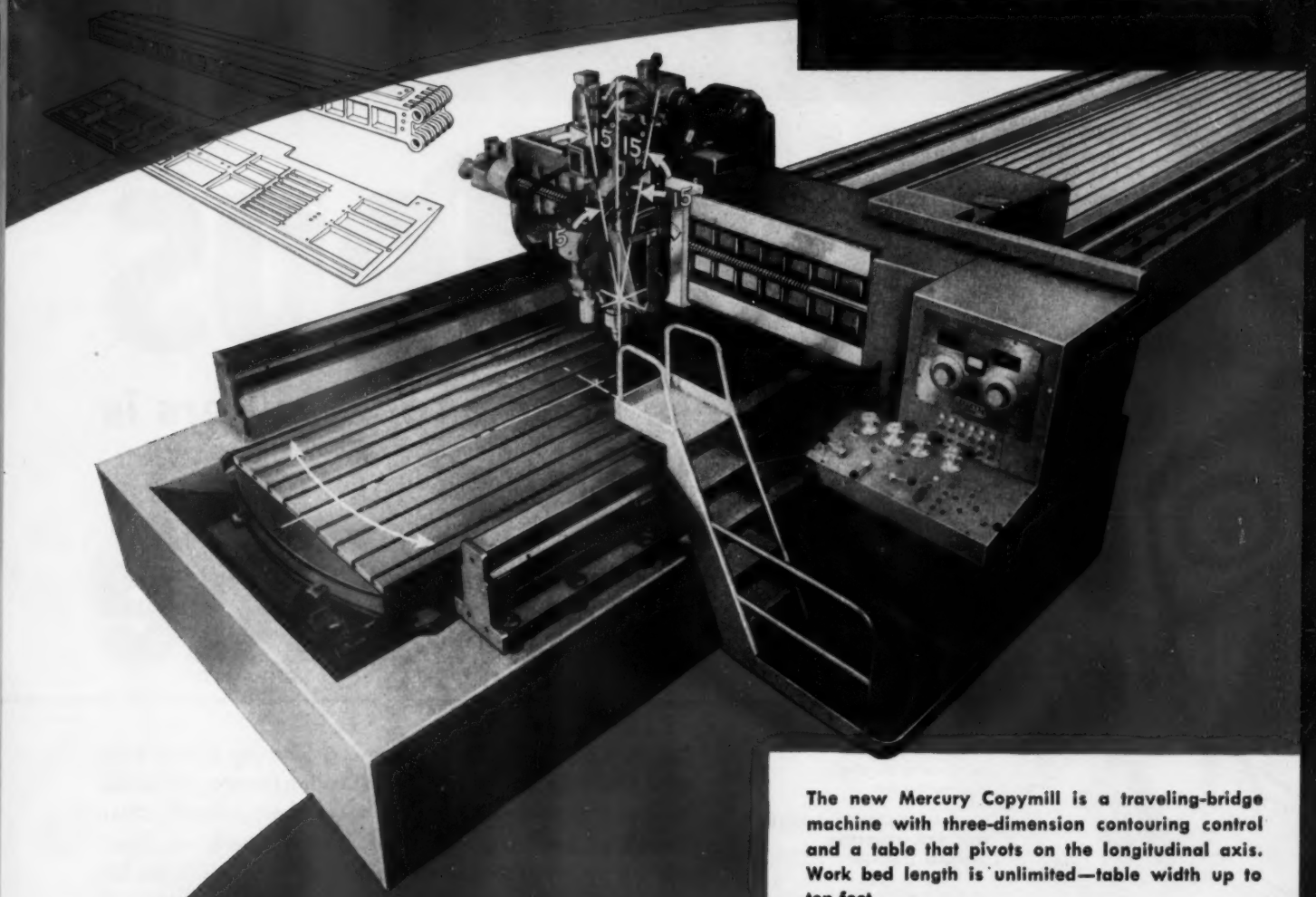
PRINCIPLES OF MACHINE DESIGN—*By Samuel J Bernhard, M E, professor of Mechanical Engineering, Emeritus, Brown University; Everett O Waters, M E, Strathcone professor of Mechanical Engineering, Yale University; and Charles W Phelps, M E, asst professor of Mechanical Engineering, Yale University. Published by Ronald Press Company, 15 E 26th St, New York 10. 634 pages. Price $7.50.*

A realistic approach to machine design must include careful coordination of theory and present-day work-ink standards, and this the authors have done by including a number of tables of standard data—for example, SAE and ASTM designations for bearing materials, and fit classes for shafts.

The book contains the usual spread of standard information necessary for machine-design study (college level), a new method of rating hp capacity of V-belts, and sample design problems at chapter ends. Subjects covered include fasteners, shafts, bearings, and a larger-than-normal proportion of coverage on

Model R53
Sensitive Drilling Machines

MERCURY special machines



The new Mercury Copymill is a traveling-bridge machine with three-dimension contouring control and a table that pivots on the longitudinal axis. Work bed length is unlimited—table width up to ten feet.

Wing skins and spars for airframe construction are accurately machined from solid aluminum with Mercury's high-speed Copymill. Incorporating many of the outstanding features developed for special Mercury machines, the ingenious Copymill is another example of Mercury versatility in the design and manufacture of specialized heavy-duty machine tools. You may find a quick and economical solution to your own machining problems with a Mercury-built machine.

MERCURY
ENGINEERING CORPORATION

Milwaukee 2, Wisconsin

Your Inquiry Is Invited

Cummins Portable Tools

Thor PORTABLE POWER TOOLS

Model R53
Sensitive Drilling Machines
THE HIGH SPEED HAMMER CO., INC.

Buckeye Tools CORPORATION
DAYTON 1, OHIO

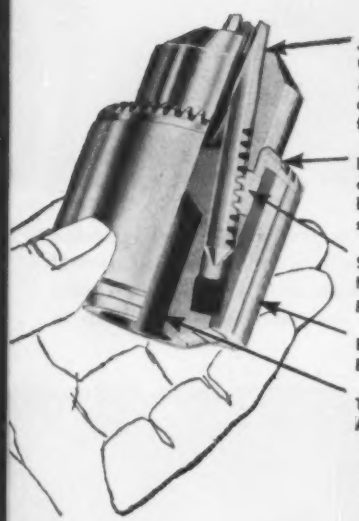
producers of the world's first successful rotary air tools

SKIL PORTABLE TOOLS

UNANIMOUS

Every one of these power tool makers is equipping new products with

Supreme BRAND



JAWS NICKEL CHROME MOLY ALLOY STEEL . . . expertly heat treated for durability

KEY HOLES— do not extend into body cavity thereby sealing out dirt

STURDY ONE PIECE GEARED NUT CONSTRUCTION . . . prevents slippage

ENTIRE CHUCK BODY HARDENED—Inside and Out

TAPER BORE HARDENED AND GROUND

INDIVIDUALLY TESTED FOR ACCURACY

CHUCKS AND KEYS interchangeable with other makes

At the left is a cutaway drawing of a Supreme Chuck with some notations on the chuck's outstanding features. We could have written this advertisement about those features. But, though we feel them worthy of your attention, we think you'll get a better idea of the quality of Supreme Chucks by studying the trade marks on this page. Each of them is a Supreme Chuck Customer. Still other leading power tool makers, not listed here, are now testing and using Supreme Chucks.

The standards of these firms are high, but Supreme Brand Chucks have equalled or surpassed the requirements of them all. That is why Supreme feels that the strongest claim it can make about the excellence of its chuck is its acceptance by

Always demand Supreme Chucks for...

IT'S A Hamilton Tool
USE IT WITH CONFIDENCE

FAIRCHILD
A Famous Name in Industry
QUALITY ELECTRIC TOOLS
110 MAIN STREET . . . BURLINGTON, VERMONT

Commander
PRODUCTION TOOLS
MULTI-DRILL, TAPPER, LEAD-MATIC TAPPER, SELECT-A-SPINDLE, MULTI-ANGLE DRILL UNIT

Porter-Cable
Quality Electric Tools
SYRACUSE 8, NEW YORK

ENGINEERING CORPORATION

Your inquiry is invited

SIOUX
Trade Mark Reg. U.S. Pat. Office
STANDARD THE WORLD OVER

Cummins Portable Tools
MADE BY John Oster T.M.
MANUFACTURING CO.

DYNA-FLASH
HEAVY DUTY QUALITY ELECTRIC TOOLS

ARO
QUALITY-BUILT AIR TOOLS FOR INDUSTRY

IN A COMPLETE VARIETY OF SIZES AND TYPES

Chucks!

each of these great companies. They looked, tested, retested, abused the chuck until they were certain it could perform to the highest possible standards. It is unlikely that industrial buyers of chucks will have the time or inclination to test chucks so thoroughly. It is unnecessary—simply accept the indorsement of those buyers who, when they bought, had to be right.

Let your distributor show you—on one of your own machines—how the fully interchangeable Supreme Chuck ... that's hardened inside and out ... can deliver the extra performance that will keep your tool costs down. SUPREME PRODUCTS, INC., 2222 SOUTH CALUMET AVENUE, CHICAGO, ILLINOIS.

VISIT BOOTH 432 ... TRIPLE MILL SUPPLY CONVENTION ... CLEVELAND

...EXTRA PERFORMANCE

TOOLCRAFT CORPORATION
Darra POWER TOOLS James
SPRINGFIELD, MASSACHUSETTS

PET POWER TOOLS

walker-Turner
LIGHT HEAVYWEIGHT MACHINE TOOLS

POWER Shopmate TOOLS

Blue Diamond Tools
Manufactured By
PIONEER GEN-E-MOTOR
CORPORATION Chicago 39, Illinois

THE Bradford MACHINE TOOL CO

Air and Electric Tools
Ingersoll-Rand

Thor SpeedTools

MULTI-DRILL, TAPPER, LEAD-MATIC TAPPER,
SELECT-A-SPINDLE, MULTI-ANGLE DRILL UNIT

SYRACUSE 9, NEW YORK

...more than meets the eye!
There's only one way for you to find out just how good Chicago-Latrobe Drills really are. That way is to try them. Try them and watch your production go up. The finer steels, the engineering skills, the extra experience in the use of carbides . . . all the extras that go into these fine tools show up finally in what our customers call "extra cutting mileage." Ask your distributor for
CHICAGO-LATROBE
High Speed and Carbide-Tipped DRILLS
Extra service too!
Your Chicago-Latrobe Distributor specializes in "on-time" delivery. And—he is a drilling and reaming expert who offers free counselling service on your tough problems. Call him in soon.
CHICAGO LATROBE

DOUBLE CIRCLE TOOLS

Chicago-Latrobe

416 WEST ONTARIO STREET CHICAGO 10

• DRILLS • COUNTERSINKS • CARBIDE TOOLS
• REAMERS • COUNTERBORES • SPECIAL TOOLS

gears. Links, cams, and brakes are also treated.

The text includes a good proportion of illustrations, heavy on sketches and drawings, but with photos where they show particular characteristics. Written material is not overly wordy nor loaded with the kind of uselessly schoolish language that has ruined so many good texts in the past.

Major sections of the text are entitled: Introduction; Fasteners; Shafts, clutches, bearings; Drives; and Mechanisms.

•

CONVERSION FACTORS AND TABLES (2ND EDITION—*By O T Zimmerman and Irvin Lavine. Published by Industrial Research Service Inc, Masonic Bldg, Dover, NH. 525 pages, 4½ x 6 in. Price $5.*

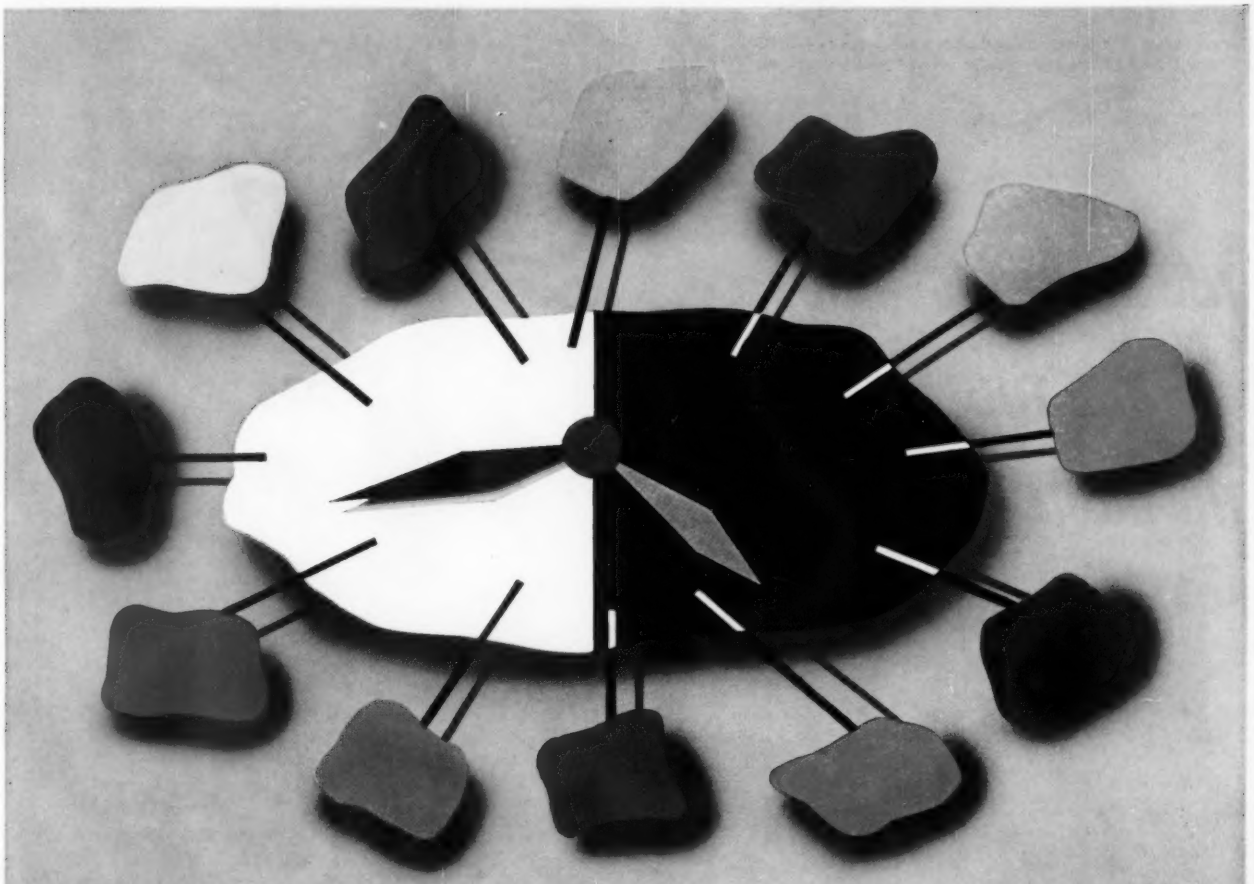
Everyone concerned with the mechanic arts, be he an engineer in any field, a chemist, physicist, mathematician, patent attorney, advertising executive, or even a physician, is frequently confronted with the problem of converting some unit of measurement into some other unit. Must you convert ergs into watt-hr, quarts into kilderkins, yards into wave lengths of red line of cadmium, sidereal years into mean solar minutes, or merely tons into ounces? How many handbooks must you search through? How many sources must you investigate? And how many times must you be irritated by finding every conversion but the particular one you want?

With this book on your desk, you have merely to turn to the alphabetical list to find Tons (long) to Ounces (avdp) and the multiplier 35,840. If it's the other way around, look under Ounces to Tons and find the multiplier 2.790179×10^{-5}.

Even if you are concerned with foreign measurements, there's a separate section, classified by countries, in which you can find that in Ceylon, you must multiply a Guz by 2 to obtain Moolums, or by 3 to obtain feet. Or if you are doing business with Germany, you may want to know that you must multiply a Pfund by 1.23 to obtain the equivalent in pounds.

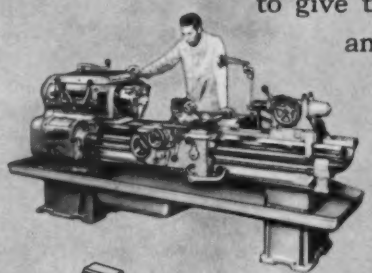
In addition to all this there are some 120 pages of tables ranging from hardness conversions to wire gages.

It is not often that a book reviewer waxes lyrical over so dull a subject as conversion factors, but this reviewer considers this volume to be the most useful and practical piece of work that has appeared in years. It is finding a permanent place on his personal book shelf.



measure of profit — or loss

Minutes purchased through payroll—and particularly the higher-priced minutes of skilled machinists—are identical in the cost column but not always so on the profit and loss sheet. Axelson lathes have been designed to give those precious minutes maximum value both in set-up and running. In every type of work, Axelson lathes have been making man-hours mean more since 1915. If you want particulars, just ask us to show you.



AXELSON LATHES

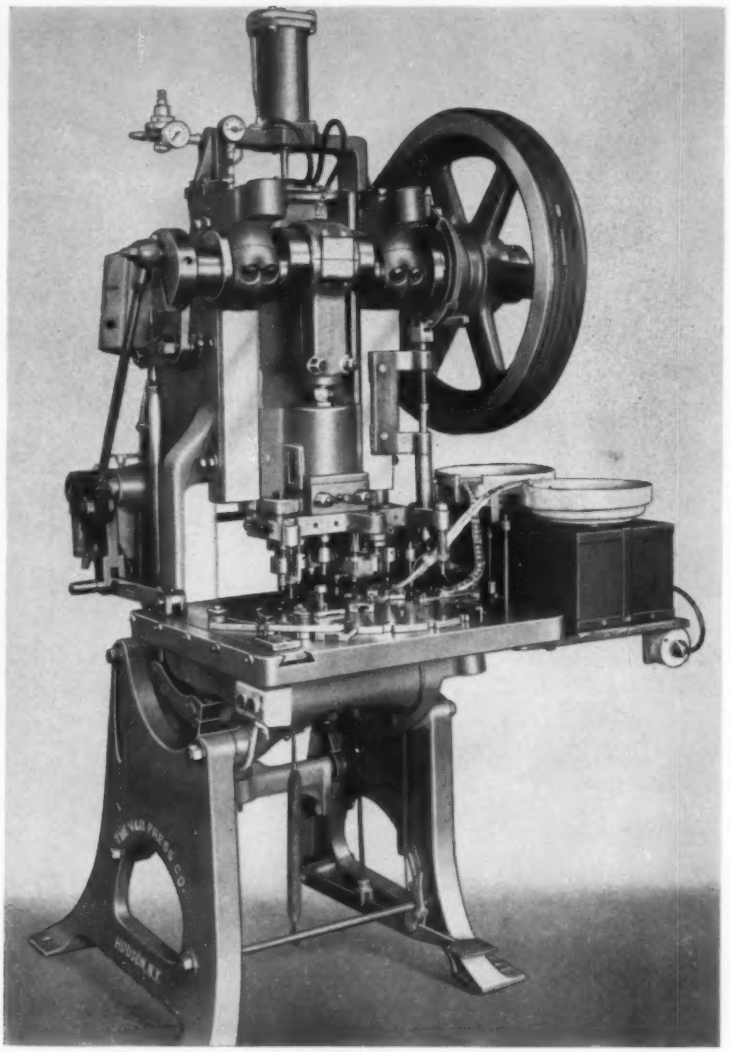
make man hours mean more

AXELSON MANUFACTURING COMPANY

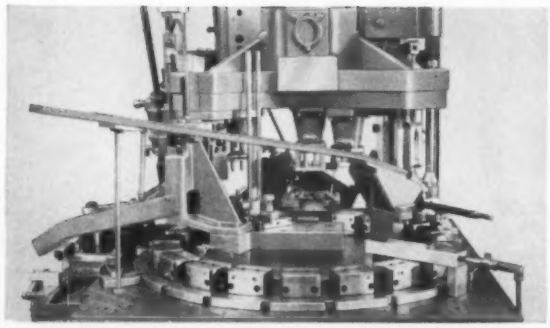
DIVISION OF U. S. INDUSTRIES, INC.

6160 S. BOYLE AVENUE, LOS ANGELES 58, CALIFORNIA • Dealers in Principal Tool Centers of the U. S.

Complicated dies synchronized with hopper feeds require consistent accuracy—you're sure of it with V&O.

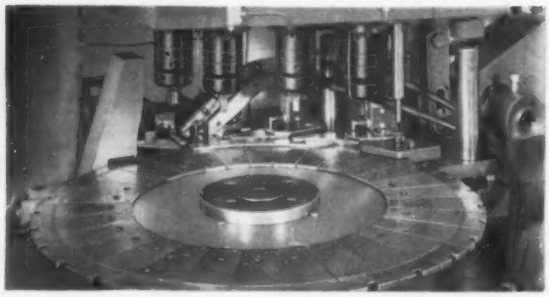


THE MORE INGENIOUS THE TOOLING THE MORE REASON TO GO V&O



Complex tooling like this needs V&O precision stroking . . . otherwise maintenance would be prohibitive.

Forming square nuts out of round stock requires sturdy, precise punch travel — you get it on a V&O.



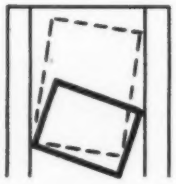
Complex tooling requires and deserves maximum press accuracy. That's why you'll find V & O's wherever ingenuity has demanded the support of precision press operation. Since they were first designed, V & O presses have been built like machine tools. Long slide precision stroking and hand-scraped ways in combination with all around sturdiness of construction assure dependable working accuracies day in and day out.

If you design your own tooling, make sure of optimum performance by putting it on a V & O press. If you have a special production problem that can be solved by automated, high precision tool motions and feeds, take it up with V & O.

Our representative will be glad to tell you more about the V & O presses and the engineering available for equipped production units. Write us, please.

WHY THE V&O LONG SLIDE PROVIDES BETTER ALIGNMENT

With the same running clearance, the longer the slide the less possibility for angular misalignment. And we keep our running clearances extremely close.



THE V&O PRESS COMPANY

Division of Emhart Mfg. Co.

301 UNION TURNPIKE, HUDSON, NEW YORK

Builders of Precision Power Presses and Feeds Since 1889

New Films

PRODUCTION TOOLING—*Produced by The DoAll Co, 254 North Laurel Ave, Des Plaines, Ill. 16 mm, sound, color. Running time 10 min. No charge.*

Based on the problem of producing huge extrusion dies for the country's biggest aluminum extrusion press (*AM*—Dec 6 '54; p 162), this new film shows the development and construction of the world's largest bandsaw. Close-ups show details of cutting action and the function of the electrically powered worktables controlled by a simple steering wheel. The picture is recommended as a companion picture to Production Band Machining (*AM*—Mar 28 '55, p 216)

•

SLIDE LECTURES ON HYDRAULICS—*produced by the Denison Engineering Co, 1236 Dublin Rd, Columbus, Ohio.*

Series of slide lectures ranging from 6 to 15 slides per lecture, to describe various hydraulic principles, including axial-piston pumps and motors; vane pumps and motors; directional valves; surge damping valves; flow controls; and hydrostatic valves. Complete program or any specific subject-lecture available to colleges, company training programs, and other qualified groups.

•

A WAY OF THINKING—*Produced by Cincinnati Lathe & Tool Co, Cincinnati 9, Ohio. Sound, color, 16 mm. Running time 15 min. No charge.*

How to combat obsolescence in order to maintain an adequate defense base and, at the same time, hold a strong competitive position, is told in this new film. The presentation is made by the technique of having a business paper reporter tell the story of plant modernization.

•

NEW HORIZONS FOR QUALITY—*Produced by The Sheffield Corp, Dayton 1, Ohio. 35-mm slide film, sound. Running time 14½ min.*

Designed for engineering and production audiences, this new film pictures the application of Plunjets to machine control, multiple-dimension inspection, and numerous other applications.

BE *Sure* YOUR NEW ENGINE LATHE CAN *Take* IT!

The engine lathe you buy today could be the one you will call upon for 'round-the-clock production. Make sure, before you buy, that the lathe of your choice can take such punishment.

ASK ONE QUESTION!

What is the headstock gear arrangement?

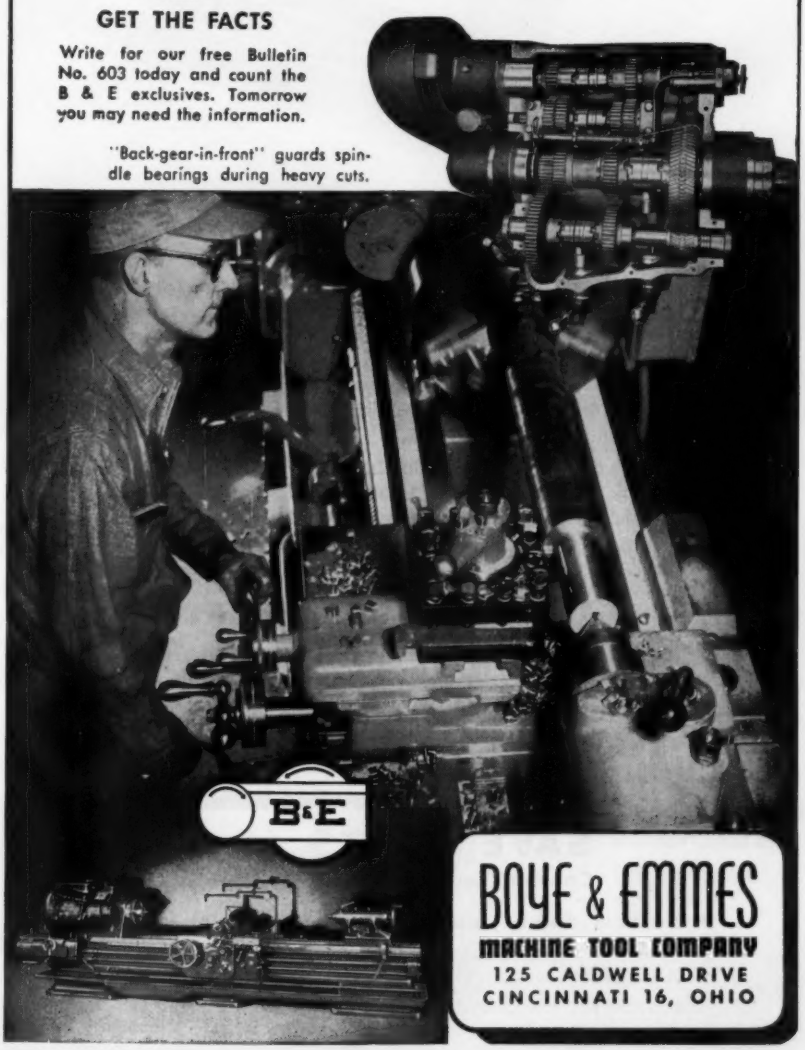
MAKE SURE OF THREE POINTS

(1) That all gears are arranged in a horizontal plane; easy of access.
(2) That gears are in constant mesh, with speed changes effected by means of sliding jaw clutches; eliminating gear wear due to shifting action.
(3) That the "back gear" is in *front* of the spindle, exerting its powerful downward thrust to offset the lifting action of the tool when heavy cuts are made.

On these three points long life for engine lathes depends. At these three points Boye & Emmes Long Life, Heavy Duty Engine Lathes excel.

GET THE FACTS

Write for our free Bulletin No. 603 today and count the B & E exclusives. Tomorrow you may need the information.



"Back-gear-in-front" guards spindle bearings during heavy cuts.

BOYE & EMMES
MACHINE TOOL COMPANY
125 CALDWELL DRIVE
CINCINNATI 16, OHIO

You'll find this Completely New LUFKIN CATALOG A Valuable Reference Manual

This complete new catalog lists many outstanding new items and improvements reflecting Lufkin's 86 years of leadership in the industry. 320 pages, 8" x 11" in size, contain complete information on over 4,000 numbers in the Lufkin line. In addition to all-new illustrations and completely descriptive text and specifications, it has "cut-away" drawings and action photos to help you in your purchasing. 12 pages of handy reference tables will also prove useful. This catalog will provide you with valuable reference data on precision tools, tapes or rules.

Ask your Industrial Distributor or write today for a copy of the brand new Lufkin General Catalog No. 14. For those concerned with precision tools only, ask for the new pocket size 5" x 8" precision tool catalog No. 8. For those concerned with tapes and rules only, ask for the 5" x 8" tape and rule catalog No. 104.

BUY LUFKIN TAPES • RULES • PRECISION TOOLS

THE LUFKIN RULE COMPANY, SAGINAW, MICH.
132-138 Lafayette St., New York City • Barrie, Ontario

357

SAVE COSTS

Consult Your Industrial Distributor

- He cuts down your inventory investment in tools and parts.
- He cuts your purchasing costs by providing one source for thousands of items.

Names in the News . . .

Roy L Salter, vice president of American Brake Shoe Co's Southern Wheel Division, has been promoted to first vice president.

Flexonics Corp, Maywood, Ill, manufacturer of metal hose and components, has elected **George G Toepper** vice president, manufacturing, and **Thomas K Wells,** vice president, sales.

Walter H Barling, designer and builder of America's first heavy bomber in 1923, has retired from Convair-Fort Worth after fifteen years' service as supervisor of process control and superintendent of inspection.

George W Kross, Jr, assistant superintendent of Babcock & Wilcox Co's Tubular Products Division plant in Alliance, Ohio, has been named superintendent. **Carl J Stoops,** manager of mill scheduling, traffic, and steel inventories, succeeds Mr Kross.

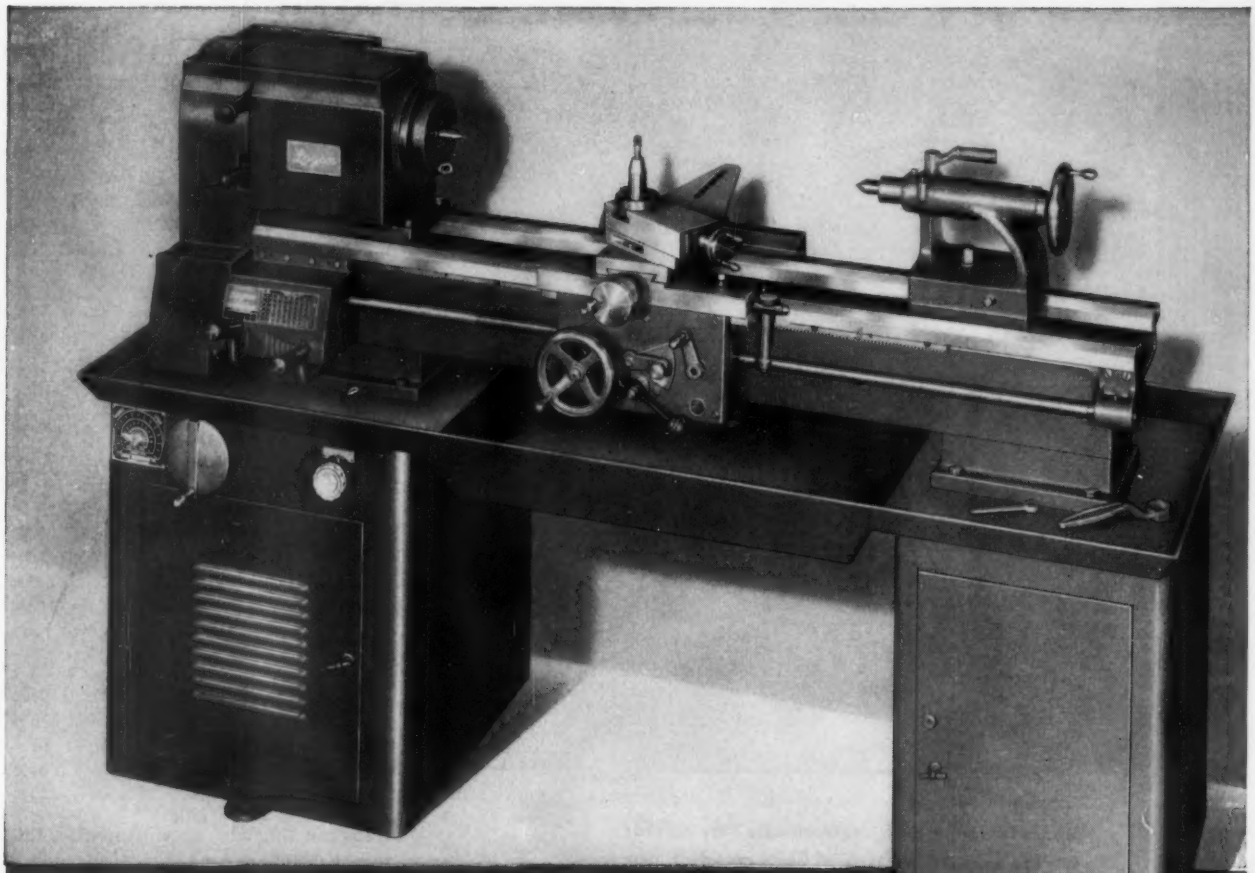
Karl Schwartzwalder, director of research at AC Spark Plug Division of General Motors, has been named president-elect of the American Ceramic Society. After a year's term in this office, he automatically becomes president.

J R Parsons, formerly consulting engineer with American Associated Consultants, Inc, has been named assistant to the vice president in charge of production in the Electrical Materials Division plants of Hubbard & Co in Pittsburgh and Chicago.

Allis-Chalmers Pittsburgh Works promotes: **Milan P Getting, Jr,** assistant to the works manager, to assistant to the general manager; **George Shombert, Jr,** assistant superintendent of the electrical test department, to succeed Mr Getting; **Sebastian W Phillippi** to take over Mr Shombert's post.

Westinghouse Electric Corp names: **D W McGill,** manager of headquarters sales training, to head sales of the Steel Mill & Metalworking Section of the Industrial Department; and **Thurman L Rundlett,** staff assistant in headquarters purchasing, to the new post of assistant planning director, new products.

Ralph A Colorado has been appointed export manager for Whitney Metal Tool Co, and for Rockford Brass Works, both of Rockford, Ill.



THIS NEW 14" *Logan* LATHE PERFORMS...

AND THE RESULTS PROVE ITS SUPERIORITY

The more jobs you watch this rugged new Logan "6560" perform, the more impressive it looks. On the heaviest cuts, or at maximum speed, it turns the work *smoothly,* quietly, with precision results. Better performance than you are conditioned to expect of a "good" 14" lathe is literally designed, engineered and built into the "6560".

The Variable Speed Drive provides instant rpm adjustment on work requiring variation of spindle speed. The oversize spindle, with 1⅜" bore, turns on a ball bearing mounting that needs no adjustment within the full range of 38 to 1200 rpm. The bed is a wide, deep special alloy casting, extra heavy and resistant to both internal and external stresses. The two V-ways and two flat ways are precision ground. There is extra strength in the wide gears, heavy bearing supports, massive headstock, carriage and base. This extra weight, plus dynamic balancing of the complete lathe practically eliminates vibration. Remarkably moderate price and low cost operation make the "6560" outstanding in economy as well as in precision performance. See it at your Logan Lathe dealer's, or write for Bulletin 14-L, giving a full description.

SPECIFICATIONS AND FEATURES

14⅝" swing over bed
9" swing over saddle
1⅜" spindle hole
1" collet capacity
40" between centers

Variable Speed Drive
Ball Bearing Spindle
38 to 1200 rpm
Two-V-way, Two-flat way Precision Ground Bed
Precision Carriage

LOOK TO LOGAN FOR BETTER LATHES AND SHAPERS

LOGAN ENGINEERING CO.
Lawrence and Lamon Ave., Chicago 30, Ill.

Whatever your gear requirements may call for with respect to size, type of basic material, accuracy, quantity, delivery schedules . . . a call at Perkins today can bring you many more practical reasons why, for precision custom-made gears, it's a good idea, and good economy too to CALL PERKINS FIRST for quotations!

PERKINS MAKES : bevel gears, ratchets, sprockets, ground thread worms, spiral gears, helical gears, spur gears with shaved or ground teeth.

NOTE: The PERKINS PRECISION SPRING COILER is the latest development in the spring coiler field and eliminates entirely the use of arbors and long set-up time. It is a complete self-sufficient machine and enables you to make the spring you want when you want it — in seconds. The coiler produces any type of spring, in any diameter and any pitch with this range: Wire sizes .005 to .125. Diameter, from 3/32" to 12" and larger. Size of the compact coiler is only 7½x16". A POWER MODEL is available. Information on request.

Perkins Machine & Gear Company

101 Circuit Avenue, WEST SPRINGFIELD, MASS.

Frank R Chase, former sales promotion manager for Multi-Clean Products Co, has been named sales manager of Torit Manufacturing Co's Industrial Division.

William L Davies, formerly associated with Athey Products Corp, has been named assistant to the vice president of Gar Wood Industries, Inc.

W J Lohmeyer, Jr, member of the sales staff of Latrobe Steel Co, Latrobe, Pa, has been promoted to district manager of the company's Pittsburgh territory.

James McMillan, vice president and treasurer of Boyer-Campbell Co, Detroit manufacturer of industrial safety equipment, has been named president. He succeeds **William P Goudie,** who will continue as a director.

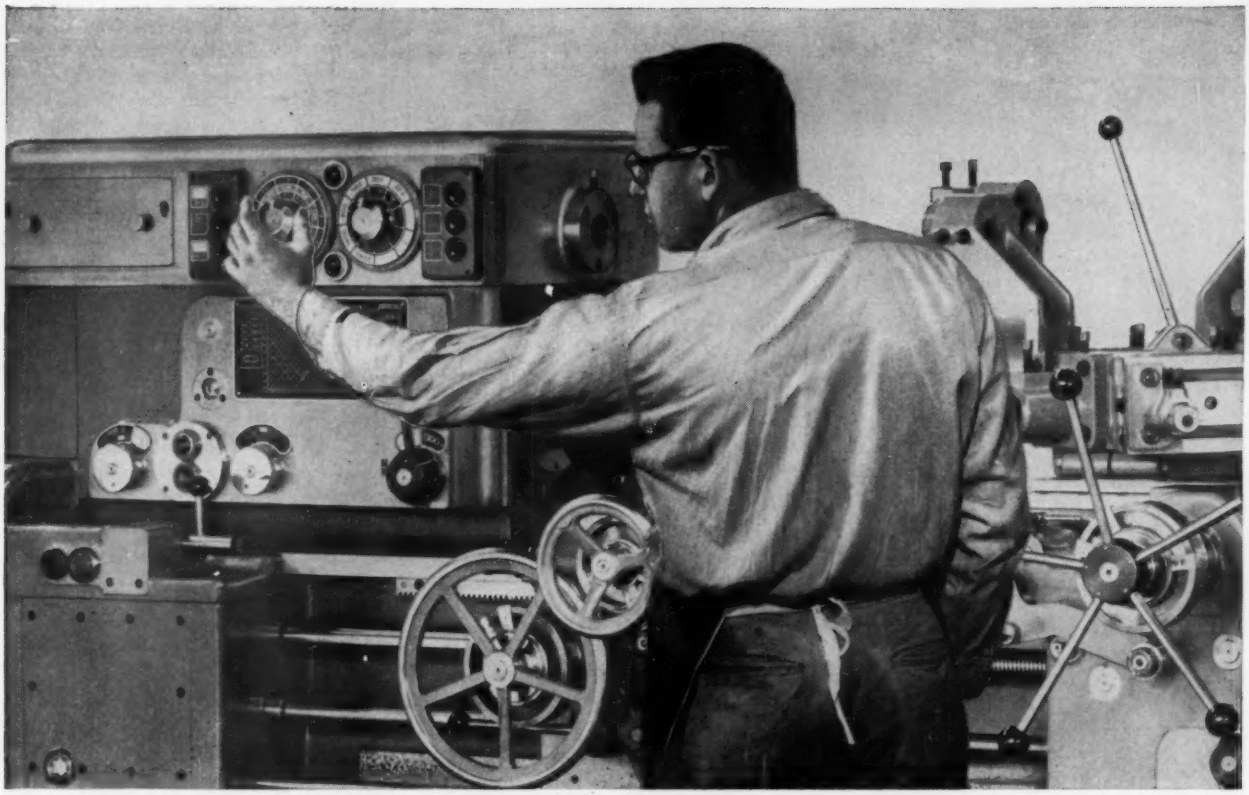
A F Anzlovar has been named vice president of the Mercast Manufacturing Corp, LaVerne, Calif, a subsidiary of Mercast Corp of New York.

General Electric appointments: **Edwin E Parker,** manager of Research Application Services Department, to general manager of the Instrument Department, Lynn, Mass, succeeding **C Howard Black,** named to manage the Construction Materials Division at Bridgeport, Conn; and **Harold C Jenseth,** manager of the San Francisco plant of the Distribution Assemblies Department, to manage the Plainville, Conn, plant.

Harold R Larsen, vice president of Servomechanisms, Inc, Garden City, NY, and manager of the company's Western Division, has been appointed general manager of both Eastern and Western Divisions. **Robert A Lehman,** assistant manager, succeeds him.

A O Smith Corp moves: **J H Brinker,** corporation director of marketing, to Kankakee, Ill, as general manager of the Permaglas Division; **S E Wolkenheim,** general sales manager of the division, to succeed Mr Brinker; and **R J Shepherd,** manager of water heater sales, to take over Mr Wolkenheim's post.

Curtner B Akin, development engineer at National Electric Products Corp of Pittsburgh, has been named assistant works manager of the Company's Ambridge, Pa, plant.



Instant changes of speed and feed. Operator simply resets position of two dials on I-T-E control box. Faulty shifting and risk of gear damage are eliminated because the gears are constantly meshed.

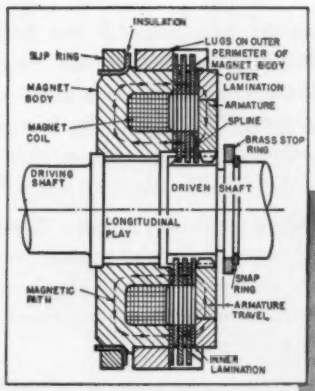
I-T-E ELECTRO CLUTCH. New power link permits rapid speed and feed changes—manual or automatic

Just by turning convenient hand dials controlling I-T-E Electro Clutches, a machine tool operator can change speed and feed rates accurately and with practically no effort or loss of production time.

Add automatic programming controls, and the machine makes these changes by itself, according to the predetermined schedule for maximum efficiency. The operator simply loads and unloads the machine.

I-T-E Electro Clutches are basically on-off coupling devices of high torque rating. They're unique in that they operate under oily conditions, and therefore are designed directly into the transmission box—saving space. They are so compact that in many cases they will fit into present transmissions and produce a greater number of speed changes without altering existing dimensions.

When you order new machine tools, insist on I-T-E Electro Clutches. There are over 70,000 already in use. Write for Bulletin 5306 for complete description. Dept. MA-4, I-T-E Circuit Breaker Company, Transformer and Rectifier Division, 19th & Hamilton Sts., Phila. 30, Pa.

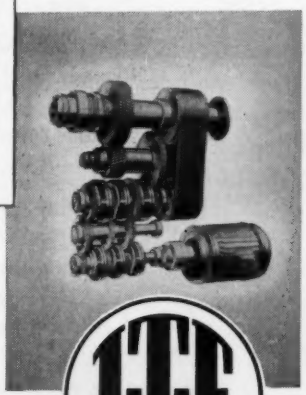


Principle of operation

Alternate laminations key with perimeter lugs and splined shaft respectively. Rotate freely until magnet coil is energized. Magnetic flux compresses the laminations with great force, engaging clutch.

Typical arrangement

Milling machine gear layout using eight I-T-E Electro Clutches gives 16 speeds. Clutches are available in ratings from 1.8 to 7200 ft/lb starting torque and 3.2 to 13,000 ft/lb running torque.



I-T-E CIRCUIT BREAKER COMPANY Transformer and Rectifier Division

NOW! THESE NEW BULLETINS

TELL ALL ABOUT

BRIDGEPORT GRINDING AND ABRASIVE CUT-OFF MACHINES

With their recent acquisition of the Bridgeport Line, LOBDELL UNITED DIVISION, United Engineering and Foundry Company, announces the publication of these two new bulletins. One covers the Bridgeport Line of Grinding Machinery and the other explains the Bridgeport Line of "ABRASAW" Abrasive Cut-Off Machines.

In the Grinding Machinery bulletin, illustrations, specifications and features are well brought out on the complete range of sizes of Face and Knife Grinders, Vertical Spindle Surface Grinders, Traveling Head Knife Grinders and Floor Grinders.

Similar information is equally as well illuminated in the "ABRASAW" Cut-Off Machine Bulletin—also, some interesting performance data and photographic examples.

Write for copies of these bulletins to:

LOBDELL UNITED DIVISION

1836 WILMINGTON 99, DELAWARE 1955

UNITED ENGINEERING AND FOUNDRY COMPANY

A M Davis, former chief production engineer of A V Roe Canada, Ltd, has joined the power-plants division of Marquardt Aircraft Co, Van Nuys, Calif, as chief of engineering and manufacturing services.

Edgar F Nason, formerly associated with Elastic Stopnut Corp, has joined the Kaynar Co, Los Angeles, Calif, as general sales manager.

V Lee Cook, president of Continental Communications, Inc, Chicago, has been named president of Electronics Protection, Inc, formerly a division of Continental, and now set up as a separate company to manufacture electronic equipment.

Donald J Zeigler, Southwest sales representative for Wright Hoist and Ford Chain Block divisions of American Chain & Cable Co, has been appointed Pittsburgh district sales manager.

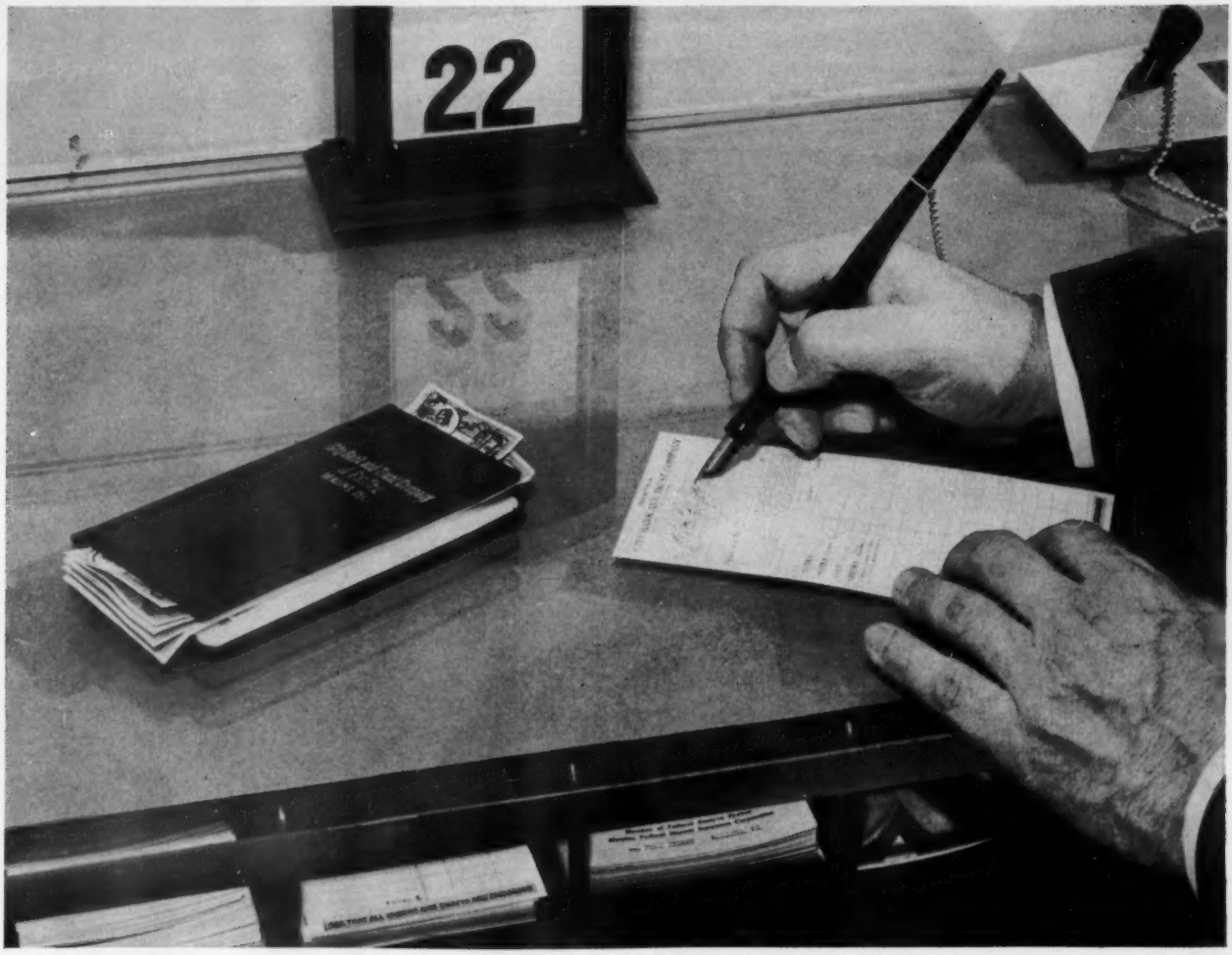
W Edwards Dungan, chief plant engineer, has been promoted to plant manager at American Viscose Corp's Roanoke, Va, facility. **William H Kreamer,** formerly assistant, succeeds him.

John S Roller, assistant to the vice president in charge of sales, has been named Detroit district sales manager for Firth Sterling Inc.

Magnus A Grunlan, formerly plant manager of the Lanston Monotype Machine Co, Philadelphia, has been appointed to a similar post at Dollin Corp, Irvington, NJ.

"Methinks we'd better organize some planned noon-time recreation 'ere someone gets hurt!"

ANTISEP the all-purpose water-soluble cutting base



JUST LIKE MONEY IN THE BANK

...The Savings from ANTISEP

How's this for economy? . . . Longer tool life, higher quality work, more output per machine and . . . all at a cost of 8c per gallon of coolant in the machine!

Aside from the fact that Antisep All-Purpose Base out-performs even the most expensive straight oils, its amazing cost savings astonish metalworking men the most.

Even so, it has other features that make it popular with machinists. Like its anti-welding properties on heavy-duty work, and its antiseptic qualities which eliminate obnoxious odors in the shop.

Ask to see the proof of Antisep's performance in metalworking plants—the Houghton Man has plenty to show you. A test can be arranged at your convenience if you write to Metalworking Research Department, E. F. Houghton & Co., 303 West Lehigh Ave., Philadelphia 33, Pa.

ANTISEP All-Purpose Cutting Base

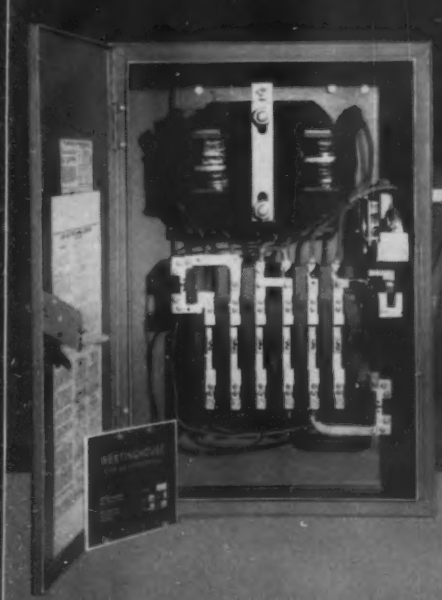
. . . a product of

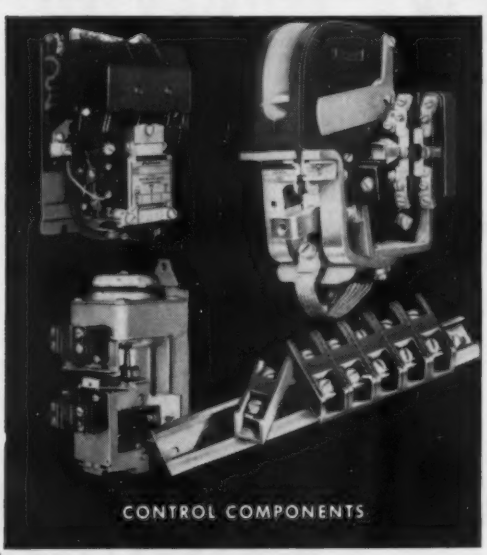
E. F. HOUGHTON & CO.

PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

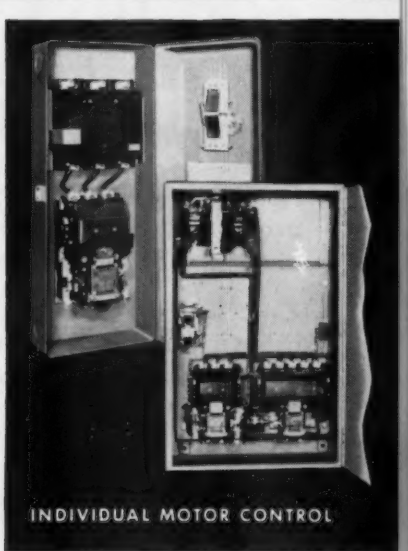
Ready to give you on-the-job service . . .

MOTOR CONTROL FACTS ON
INDUSTRY'S MOST COMPLETE LINE





CONTROL COMPONENTS



INDIVIDUAL MOTOR CONTROL

FACT:

The only manual reduced voltage starter with air break contacts in all ratings

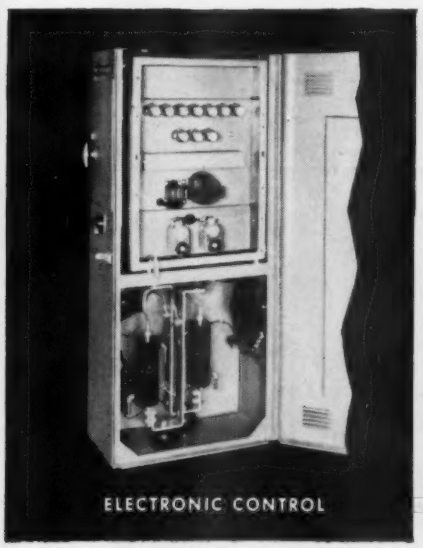
The new Westinghouse Type MB autostarter with air break double contacts eliminates the costly "oil problems" of contamination, oil level checks, spilling and messy leaking. This combined with timed acceleration makes it industry's most advanced reduced voltage starter.

Such product design advances are just part of the total advantages you gain with Westinghouse motor control. *Whatever your control problem* —from the simplest control component to complete automation—it can be solved all from *one* source—*one* responsibility.

For *all* the facts on Westinghouse motor control, call your Westinghouse sales engineer . . . *The Man With The Facts!* J-21872

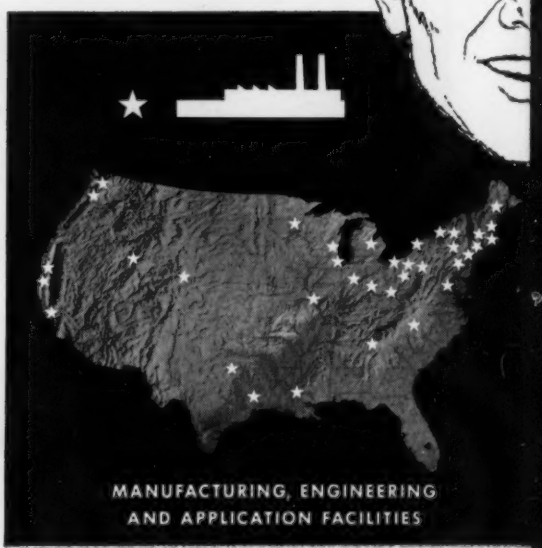
YOU CAN BE SURE... IF IT'S

Westinghouse



ELECTRONIC CONTROL

CONTROL SYSTEMS



MANUFACTURING, ENGINEERING AND APPLICATION FACILITIES

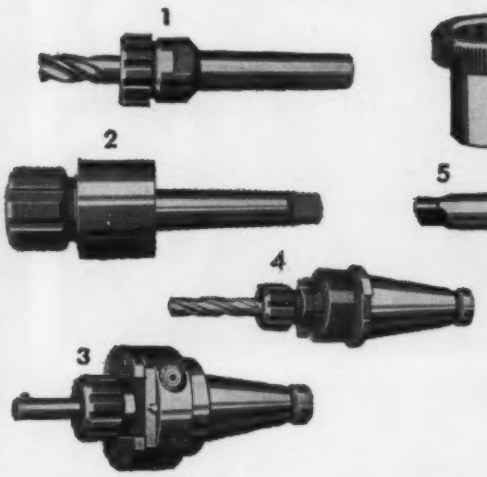
MEET THE CHAMP!

UNIVERSAL DRILL BUSHINGS BEAT ALL RECORDS FOR LONG LIFE AND ACCURACY

The extremely long life of Universal Drill Bushings is due to several factors. They are machined from finest quality steel. Their superfinished bores help to reduce both wear of the bushing and wear of the tools. Blended radius on the top inside diameter helps prevent tool hang-up and breakage. 100% concentricity and hardness tests insure accuracy and uniform quality. Knurled heads provide a quick, sure grip. Available in a complete range of standard sizes and lengths. Orders for special dimensions will receive prompt attention. For complete information, write to the office nearest you—Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.—or our home office.

179

UNIVERSAL ENGINEERING COMPANY
FRANKENMUTH 1
MICHIGAN



1 STANDARD COLLET CHUCK
2 FLOATING COLLET CHUCK
3 BORING CHUCK
4 "KWIK-SWITCH" TOOL HOLDER
5 MIKRO-LOK BORING BAR
6 STANDARD DRILL BUSHING
7 UNIVERSAL INDEX PLUNGER

HOW TO RATE A CUTTING OIL

FOR HIGH PRODUCTION ON TOUGH JOBS

There has never before been a cutting oil selection chart such as Atlantic now offers. It rates oils on job efficiency, not just chemical composition.

This cutting oil chart uses 3 variables to give you the "Cutting Units" which can then be used to select the proper Atlantic Cutting Oil for the job.

Here's what the chart does for you . . .

1 *Provides a* **CUTTING INDEX**—*or rate of metal removal*

2 *Lists* **TOOL MATERIAL**—*by type and composition*

3 *Relates* **METAL** *machinability to both Cutting Index and Tool Material*

4 *Selects proper* **OIL**—*by cross reference of Cutting Units it names the Atlantic Cutting Oil to use*

With Atlantic Cutting Oils, you can maintain high production rates on hot, tough jobs—and without foul odors. Work is visible right through the oil. The oils are compatible when blended—even down to the heaviest grades. Operators like these oils, too, because they don't indelibly stain hands or clothing.

Get complete information on these new oils and your copy of the Atlantic Cutting Oil Selection Chart. Write, wire or phone the nearest Atlantic office. The Atlantic Refining Co., Dept. R-4, 260 South Broad St., Philadelphia 1, Pa.

ATLANTIC

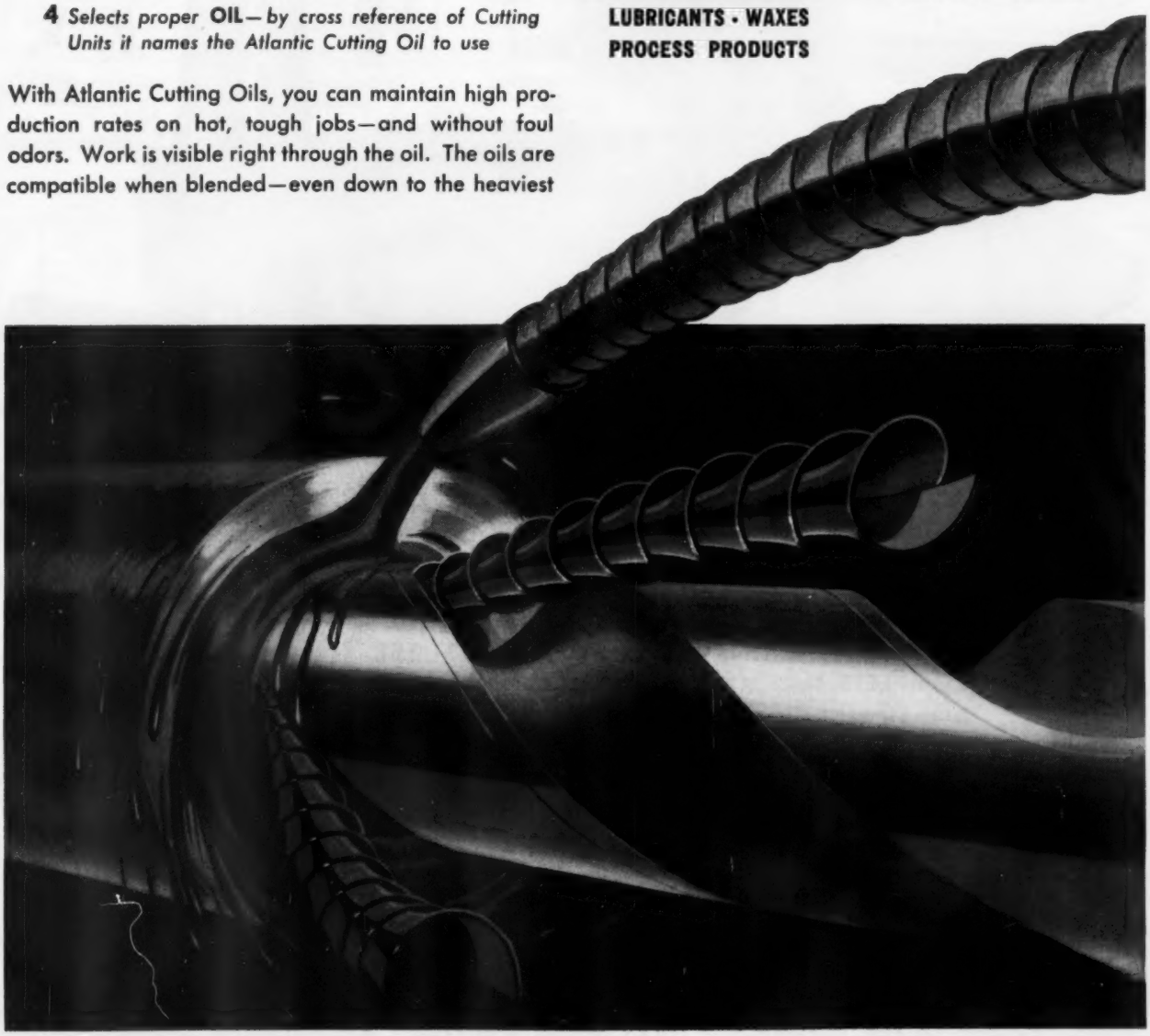
LUBRICANTS • WAXES
PROCESS PRODUCTS

PROVIDENCE, R. I.
430 Hospital Trust Bldg.

SYRACUSE, N. Y.
Salina and Genesee Sts.

READING, PA.
First and Penn Aves.

PITTSBURGH, PA.
Chamber of Commerce Bldg.

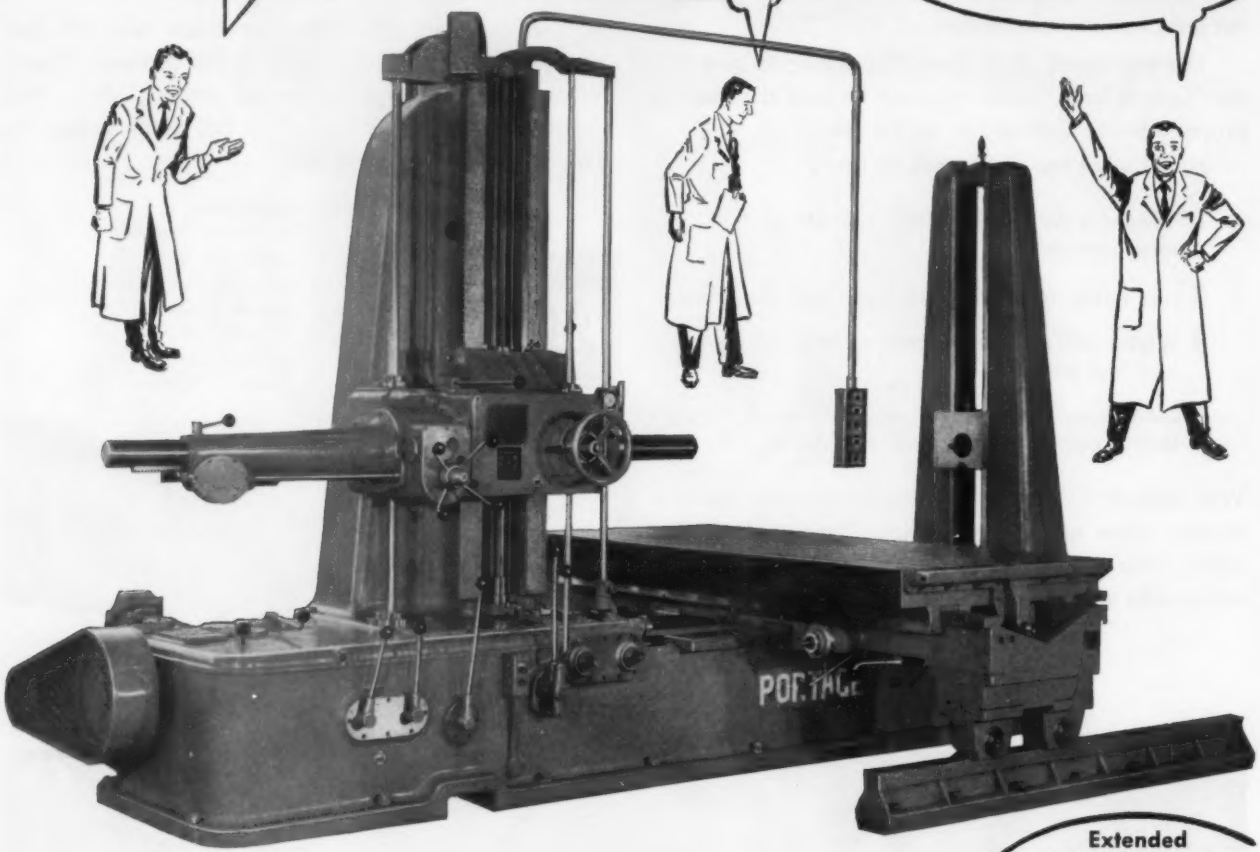


CHECK THESE *Features...*

4" spindle diameter, precision machined nitralloy steel.

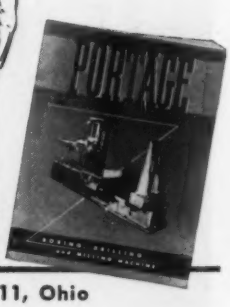
Pendent controls include spindle rotation, forward, reverse, jog forward, jog reverse and stop.

36 spindle speeds 8-1000 R.P.M. 18 Feeds.



Unusually wide and deep base, cast entirely in one piece . . . offers excellent rigidity.

Extended table saddle with adjustable supports and runways makes it possible to handle the big jobs, too!



PORTAGE MACHINE PRICES START AT $31,358 COMPLETE. The PORTAGE Horizontal Boring, Drilling and Milling Machine is a precision built tool. Only the finest of materials and workmanship go into its manufacture . . . and at a comparatively lower cost. Get ALL the facts . . . write for literature and specifications . . . *TODAY.*

PORTAGE
PRECISION MACHINE SPECIALISTS

THE PORTAGE MACHINE CO.

1026 Sweitzer Avenue • Akron 11, Ohio

Representatives in Principal Cities

BUILDERS OF PRECISION MACHINE TOOLS, SPECIAL AND PRODUCTION MACHINERY SINCE 1916

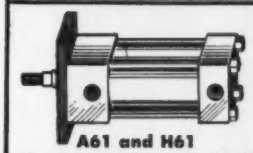
7722 Different Cylinder SELECTIONS—

Miller AIR AND HYDRAULIC CYLINDERS AND BOOSTERS "IN STOCK" for immediate delivery..

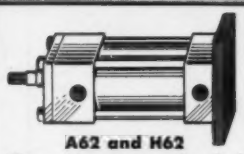
See Miller Bulletins A-105K (Air) and H-104K (Hydraulic) for Complete Dimensions and Engineering Data on these "in-stock" sizes and other Custom Miller Cylinders in bores up to 20" and strokes up to 22 feet.

"IN-STOCK" MODELS

"A" Signifies Miller 200 psi Air Cylinders; "H", 2000 psi Hydraulic Cylinders. Interchangeable Mountings Are Shown In Red On Drawings.



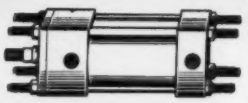
A61 and H61
Flange Mounting on Rod End



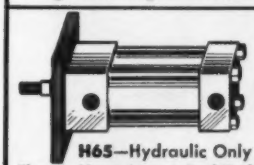
A62 and H62
Flange Mounting on Cap End

A63—8" Bore only
Flange Mounting on Rod End

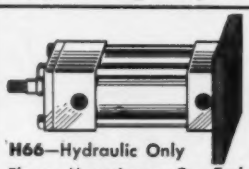
A64—8" Bore only
Flange Mounting on Cap End



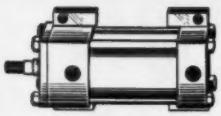
A50 & H50—Tie Rods not extended beyond nuts.
A51 & H51—Tie Rods extended both ends (shown).
A52 & H52—Tie Rods extended. Cap End only.
A53 & H53—Tie Rods Extended. Rod End only.
A54 & H54—Two Tie Rods extended at both ends.



H65—Hydraulic Only
Flange Mounting on Rod End

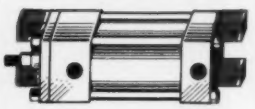


H66—Hydraulic Only
Flange Mounting on Cap End

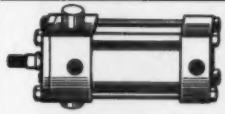


A72 and H72
Side Lug Mounting

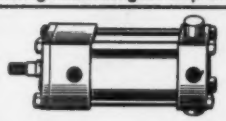
A74 and H74
Side Flush Mounting



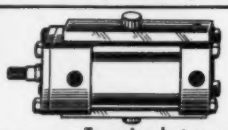
A77 and H77
Side or Foot Mounting



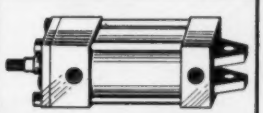
A81 and H81 Trunnion Mounting on Rod End



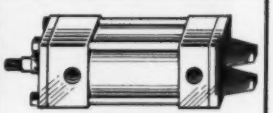
A82 and H82 Trunnion Mounting on Cap End



A83 and H83 Trunnion between Head and Cap (one week delivery)



A84 and H84
Pivot Mounting



A86 and H86
Pivot Mounting

IN STOCK BORES in Inches — "IN-STOCK" STROKES (in Inches)

	Bores	Rod Dia.	Rod Turn Down & Threads		1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
AIR	1½	⅝"	7/16-20	Cushioned																					
				Non-Cush.	1	2	3	4	5	6															
	2	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	2½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	3¼	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	4	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	5	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	6	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	8	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
HYDRAULIC	1½	⅝"	7/16-20	Cushioned																					
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12									
	2	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	2½	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	3¼	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	4	1¾"	1¼-12	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	5	2"	1½-12	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36

(1) (4) (3) (2)

"A" and "H" Models 82, 84 and 86 with strokes over 18" require stop tubes.

Column strength requires larger diameter piston rods for the following:

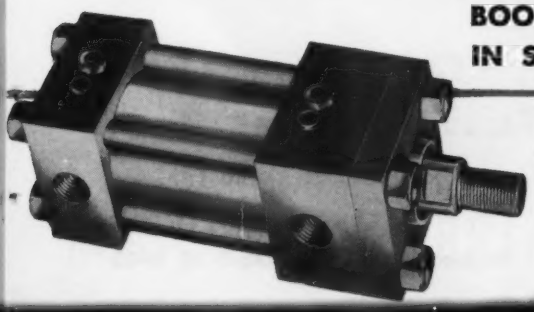
Air Cylinder Models A82, 84, and 86 with strokes inside area (1), when operated at 100 psi and over;

All hydraulic models with strokes inside area (2) and Models H82, 84, and 86 with strokes in area (4), when operated at 2000 psi and over;

Models H82, 84 and 86 with strokes inside area (3), when operated at 1000 psi and over.

Depending upon Trunnion Pin location, "A" and "H" Models 83 with standard diameter piston rods can have longer strokes than Models 82, 84 and 86.

See Miller File #251 for oversize piston rod and stop tube requirements.



BOOSTERS IN STOCK

Immediate Delivery on the following Miller 25 to 1 Ratio Boosters (80 psi air input produces 2000 psi hydraulic oil output): Model B4, 5" bore, 1" dia. ram, 6" and 12" strokes; Reciprocating Booster Model DA77-RBA8, 5" bore, 1" dia. ram, 6" stroke. Also Booster Tanks, 5" dia., 6" and 10" heights.

Write For Catalog and Stock Price List

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MILLER FLUID POWER CO.

(Formerly **MILLER MOTOR COMPANY***)*

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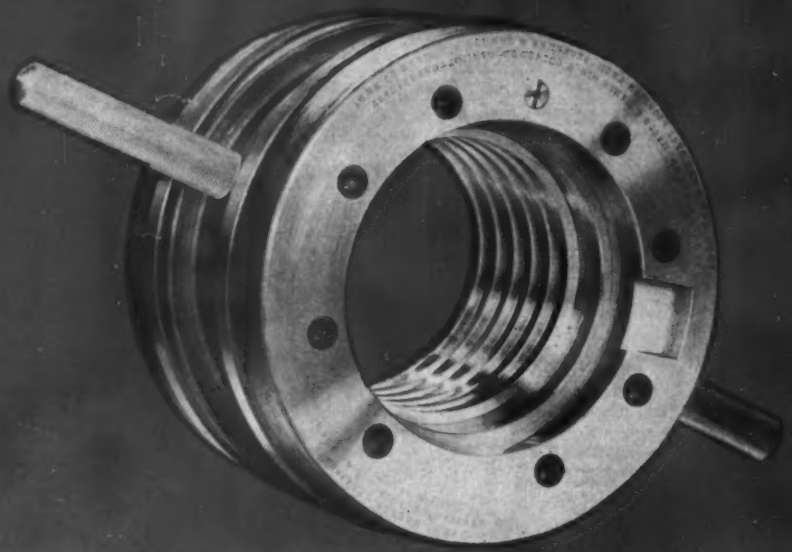
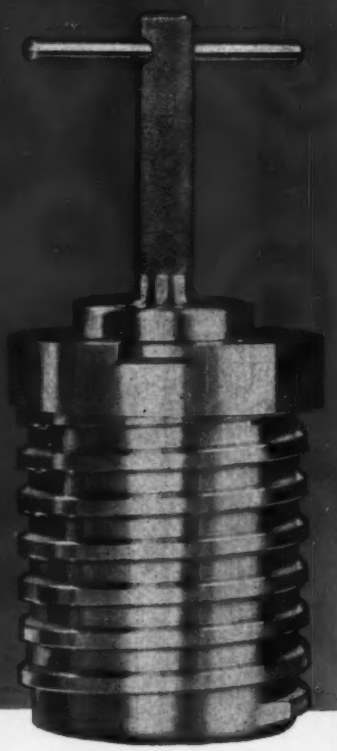
AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS

Are you Guessing ...or Gaging?





It pays to check the measure of component parts with Bath Gages, following precision machining operations. The use of guesswork or inferior gages . . . is false economy.

The special gages shown here were built to close tolerance by Bath craftsmen and illustrate the skilled workmanship that goes into the manufacture of all Bath Gages, from the most complicated design to the regular line of stock gages.

No two ways about it . . . quality shows up . . . long wear pays off . . . Bath Gages cost less in the long run by assuring extra long service at checking points.

If it's a question of "by guess or by gage" . . . a Bath representative will be glad to show you how Bath Gages will standardize your inspection routine . . . save time and money.

The Ring Gage shown above (with its accompanying Check Plug) is used for measuring the following elements of a 75 mm Gun Breech Plug: major and minor diameters, shoulder diameter concentricity, thread and key slot location from shoulder, and length of shoulder to end. Dimensions are 5.1512"–.750" Pitch, 30 degree Included Thread Angle.

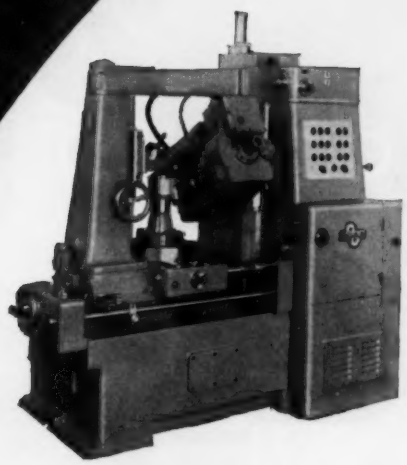
JOHN BATH & CO., Inc.

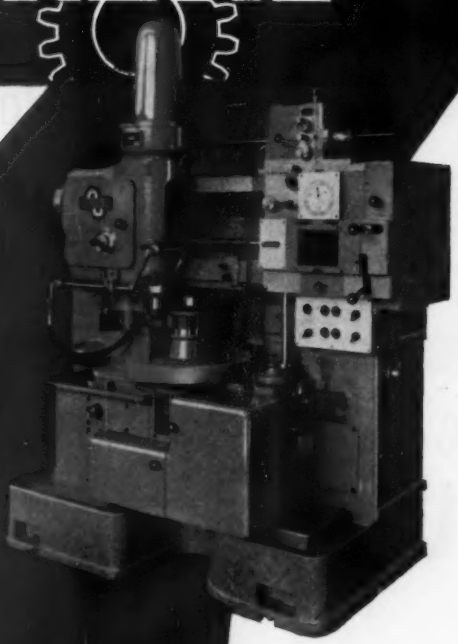
22 Grafton St., Worcester, Mass.

RING THREAD GAGES • PLUG THREAD GAGES • INTERNAL MICROMETERS • GROUND THREAD TAPS

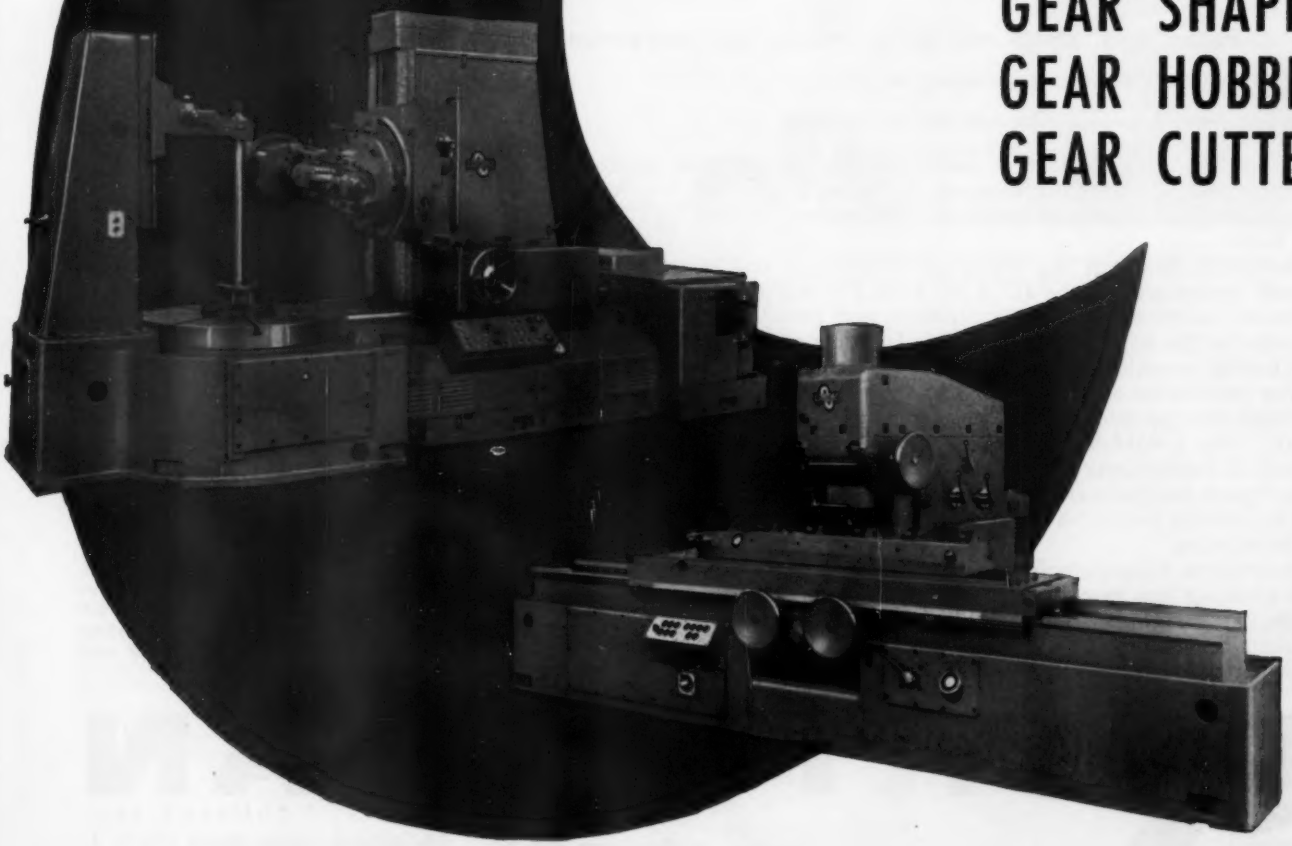
AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS

LORENZ



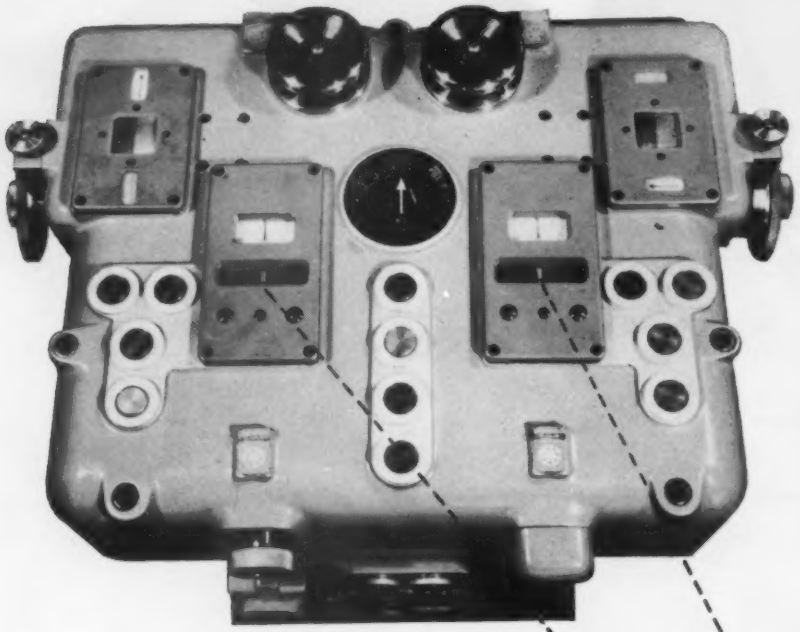


GEAR SHAPERS
GEAR HOBBERS
GEAR CUTTERS



BINDER

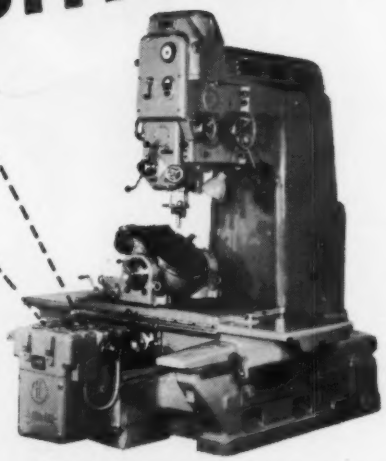
MASCHINENFABRIK LORENZ A.G., ETTLINGEN/BADEN
GERMANY



most revolutionary advance in precision hole location since the jig borer—

preselective

LINDNER AUTOPOSITIONER



Now operator can speed up initial table settings—preselect exact table position for next hole while one boring operation is in progress—do it consecutively, accurately for each hole in workpiece.

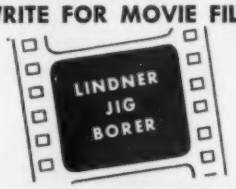
You soon see the difference in faster *initial* table settings, guaranteed accurate within .00015". In increased jig boring production, too—with the preselective Autopositioner available only on the Lindner LB15 Optical Jig Borer.

Non-productive time is practically eliminated. As one hole is completed, a push button unlocks the 44" x 24" table for rapid traverse (up to 40" per min.) movement in both directions to next preselected position. A few seconds for fine adjustment, then table is automatically locked in position and boring operation begins. Optical projection system permits exact centering—minimizes operator error and fatigue.

Direct-reading micro-optical measuring system is permanently free of wear...*only a light beam touches it.* No lead screws—therefore no back lash. Hole location may be approached from any position from either direction. Speeds and feeds are infinitely variable—spindle speeds range 25-1900 r.p.m.; milling feeds 1"-3" with power up-feed of spindle for fine finishing of bored holes.

Add to this, rugged single column construction for heavy roughing without affecting fine precision performance, and unusually deep throat for large, bulky workpieces—and you'll see why so many important toolrooms which measure precision in extremely close limits, now use one or more Lindners. Write for complete specifications on LB15 and smaller LB14 models.

SEE AUTOPOSITIONER AT WORK
WRITE FOR MOVIE FILM



This 20 minute film takes you through design, manufacture and operation of the Lindner Jig Borer—demonstrates how Autopositioner combined with unique micro-optical measuring system makes the Lindner today's most advanced jig borer. It answers many of your questions. Lindner users will fill in the rest.

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KURT ORBAN

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34 Exchange Place, Jersey City, N. J.

Toolroom and production machine tools for precision milling, boring, turning, drilling, grinding, hob grinding, gear testing.

GERMANY

factory tests prove it!

23.9 man-hours saved for every 100 lbs. of lubricant used!

Alemite cuts costs!

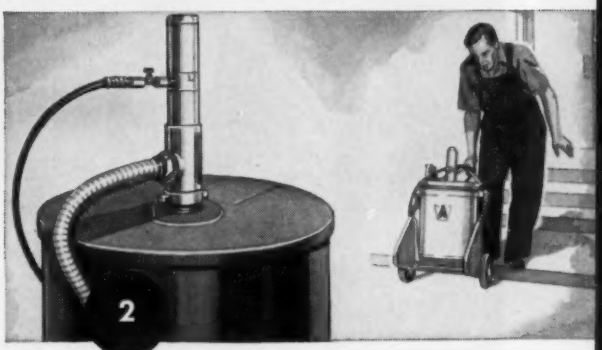
all the way from barrel to bearing ...in maintenance...repairs... down-time... YOU SAVE...STEP BY STEP!

Any machine—anywhere in your plant—can have fast, power-operated high pressure lubrication—and you save up to 23.9 man-hours for every 100 pounds of grease applied! Your machines get added protection, insurance against costly breakdowns. You save in maintenance, down-time, labor and increased bearing life.

With this combination of Alemite equipment, every bearing is protected by "refinery-fresh" lubricant at all times. There is a combination of transfer pump and power gun just right for your plant, large or small—for any lubricant, light or heavy. Power guns are available in both air operated and electric models—from 25 to 50 pound capacity.

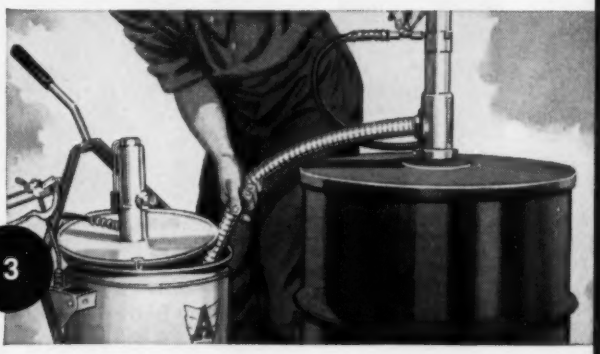
1

A drum of lubricant—any type—arrives at the plant—fresh—clean.



2

The Alemite Power Transfer Pump is inserted—lubricant is still sealed against contamination.



3

In just 60 seconds, transfer pump fills a big portable power gun with "refinery-fresh" lube.

Power gun goes to any department—even up and down steps—services hundreds of bearings!

4

With Alemite Plan "C"
Only Refinery Clean Lubricant Reaches Bearings

This combination of Alemite power transfer pumps and portable power guns is known as Alemite Plan "C". It is one of the five Alemite plans that your nearest Alemite supplier can show you. Ask him for your copy of the new Alemite Booklet "5 Plans for Better Lubrication." It will help you make lubrication plans that save money in your plant!

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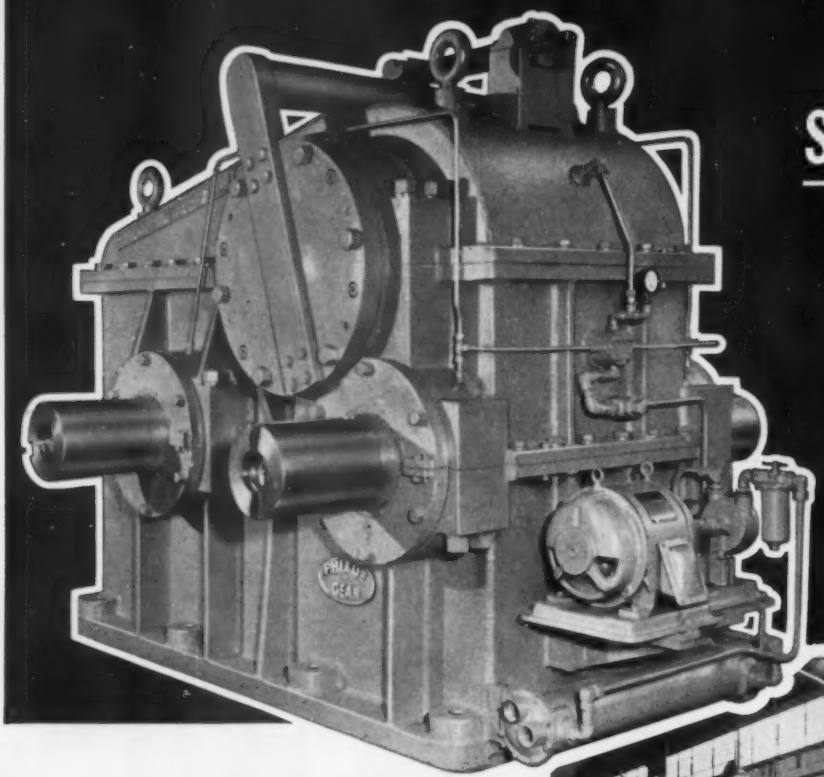
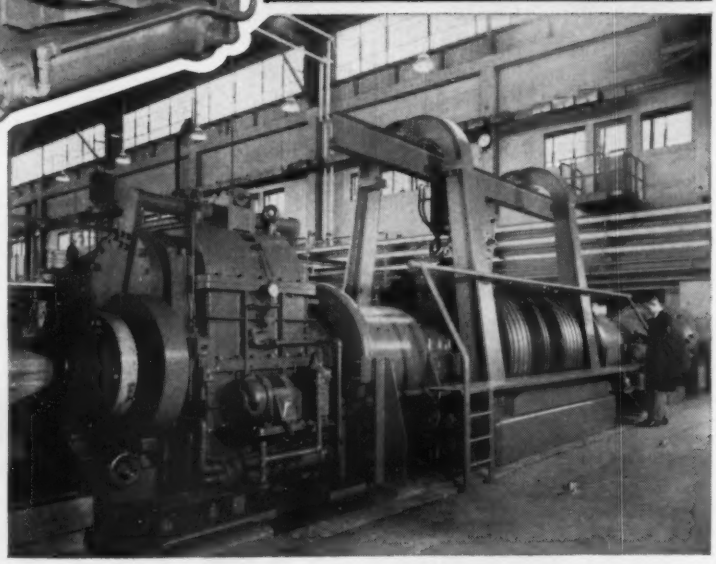


We are proud that the Johns-Manville Research Center at Manville, New Jersey, called upon us to build the huge, 10 ton specially designed gear-reduction Unit (shown above) to drive the world's largest and most versatile inertia type Dynamometer.

This Philadelphia Unit is driven by a triple speed induction motor set and clutch, and is rated 5,800 HP at 300 rpm. Gears and pinions are double opposed helicals manufactured from alloy steel forgings.

Over the years, many special Speed Reducers and Increasers for various industrial and governmental applications have been designed and built by "Phillie Gear." If you have an unusual or special drive problem . . . consult "Phillie Gear" Engineers and be assured of complete satisfaction.



Inertia-type dynamometer for testing friction materials for aircraft, industrial equipment, railroad, truck, and bus brake assemblies. The components are arranged in tandem. At the far right are the triple-speed induction motor and clutch mechanisms. Following, in order, are the inertia wheel disks, the Philadelphia reduction unit, and the torque stand to which the brake assembly at the left is attached. Complete, the dynamometer weighs 200 tons.

PHILADELPHIA GEAR WORKS, INC.

Industrial Gears & Speed Reducers

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.
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Ask Anyone in Industry

STEWART WARNER

Tool Steel Topics

BETHLEHEM STEEL

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

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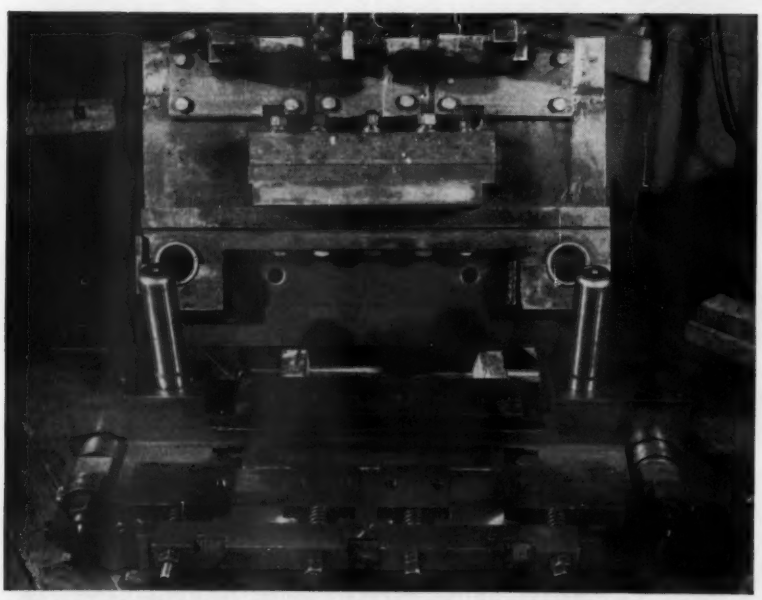
600 Stovepipe Shields Turned Out per Hour with BTR Hollow-Bar Die

In a blanking and forming operation, the Par Machine & Engineering Co., Brooklyn, uses this 58-ton press to make stovepipe shields from chrome-plated 0.015-in. steel. The die, made from five separate pieces of BTR (Bethlehem Tool Room) Hollow-Bar, is hardened to Rockwell C 60-61. It is interchangeable so that four inside diameters can be blanked and formed, and turns out as many as 600 pieces per hour.

BTR Hollow-Bar is made from our oil-hardening tool steel by a process called high-speed trepanning. With this method, hammer-forged round bars are cored out in the center, and are then rough-turned on the outside.

BTR Hollow-Bar makes it unnecessary for you to lose valuable time waiting for forged rings or discs. And there's no drilling, rough-boring, rough-facing or rough-turning required! For full information about BTR Hollow-Bar, just get in touch with your tool-steel distributor.



67 CHISEL DIE MAKES 14,000 CUTS BETWEEN GRINDS

Here's a die that's giving a good account of itself producing ends for expanded steel joists. Made of Bethlehem 67 Chisel, it blanks approximately 14,000 I-beam sections, varying in thickness from 3/16 in. to 3/8 in., before redressing is required. 67 Chisel, our chrome-tungsten shock-resisting steel, has good wear-resistance. Moreover, it is an easy steel to machine and heat-treat.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

How to "Blue" Hot-Work Tools

Regardless of the lubricant used in hot-work tools, operators of such tools are continually searching for improvement. For "pickup" of metal on the tools, though a serious problem, can be minimized by good lubrication.

"Bluing" hot-work tool surfaces is a procedure which will aid the normal lubricating procedure on virtually every type of hot-work tool. As most tools of this type are ordinarily double-tempered, "bluing" can be accomplished with no expense or delay by following this heat-treatment procedure:

1. Quench tools in customary manner.
2. Temper tools as usual, to desired hardness.
3. Grind to finished dimensions.
4. Retemper at 1000 F, or higher. Temperature should be 50 F lower than the first temper. Thus the second temper serves as the "bluing" operation.
5. Tool can be placed in service without further operations on its dark, discolored surface.

Here's something else to keep in mind: when hot-work tools are redressed, it is also wise to retemper them not only for stress-relief, but also to obtain the "bluing."

for trouble-free service

Grant Speed Reducers pay off!

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Whatever your speed reducer requirements, GRANT can supply any one of eight different types, each manufactured in a complete range of sizes.

Or if your need be something special, GRANT will make a Speed Reducer to your specifications.

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GRANT Speed Reducers, with precision-cut gears and accurately ground shafts encased in cast iron housings, assure you of long, trouble-free service.

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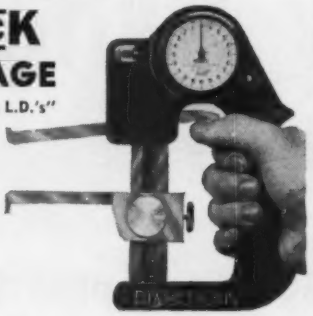
"A New Trick For Checking L.D.'s"



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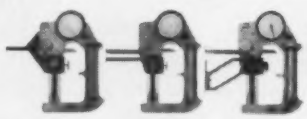
- MULTI-PURPOSE
- TROUBLE-FREE
- IDEAL for "O" RING GROOVES

A precision measuring instrument invaluable for speed, accuracy, efficiency and economy.



Standard interchangeable fingers and extensions permit checking diameters from .500" to 6.75".

Special extensions are available for larger diameters and deeper bores.

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STOP COSTLY HANDLING and moving
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MANPRO B-121 VAPOR DEGREASER

ONE COMPLETE UNIT FOR ALL SMALL PARTS CLEANING! • ABSOLUTELY ELIMINATES FIRE HAZARDS! • OFFERS 50 SECONDS CLEANING CYCLE! • CAPACITY—500 LBS. OF STEEL PER HOUR! • QUICKLY INSTALLED—HAS STANDARD POWER AND WATER CONNECTIONS!

Clean your parts or assemblies *right at the operation with the MANPRO B-121.* You can move it wherever required . . . install it in 15 minutes. You can protect your production against costly rejects. Let the MANPRO B-121 catch the defects by cleaning after machining . . . before inspection . . . before plating, painting, or bonding . . . after buffing. This low cost vapor degreaser will pay for itself quickly in man-hour savings alone!

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wear-resistance. Moreover, it is an easy steel to machine and heat-treat.

relief, but also to obtain the "lifting."

Cut Your Production Costs

whatever treatment you need:

- bright annealing
- case carburizing
- normalizing
- stress relieving
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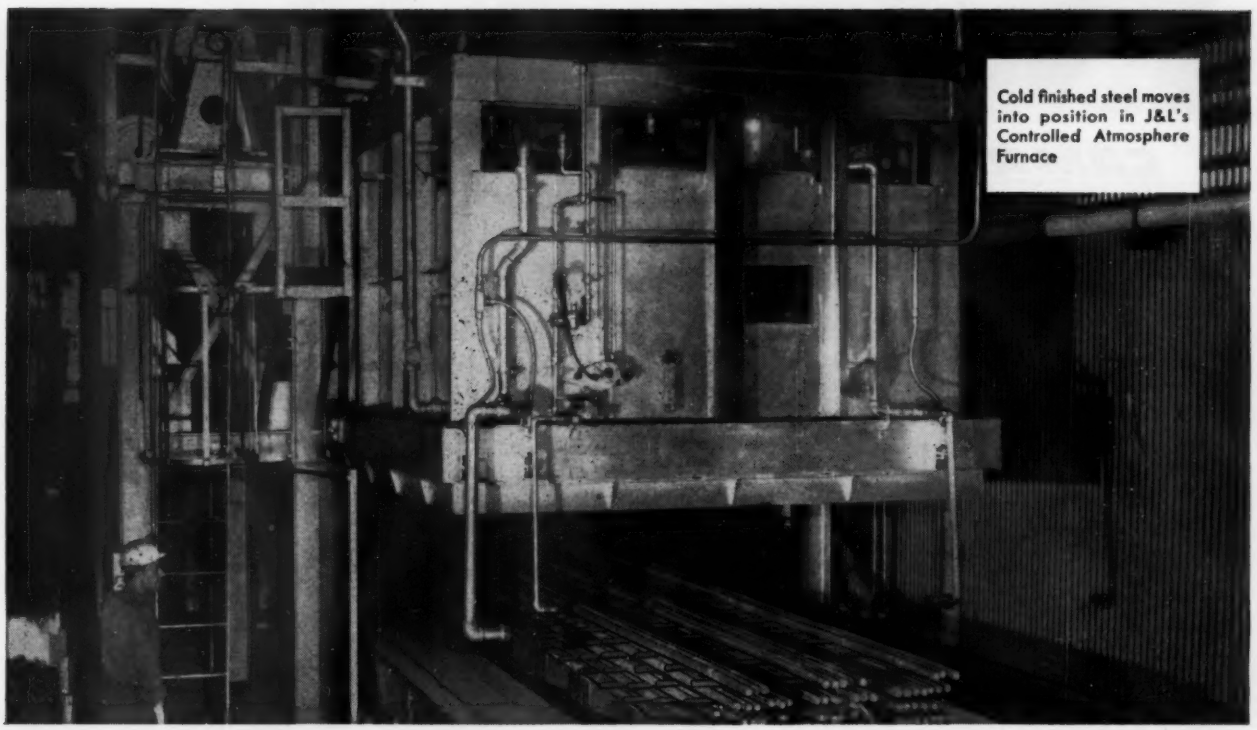
thermal treatment in prepared atmosphere furnace

saves you time
lowers over-all costs



Cold finished steel moves into position in J&L's Controlled Atmosphere Furnace

Why incur the trouble and costs of thermal treatments when J&L can do the job for you . . . quickly and economically? J&L's Controlled Atmosphere Furnace can be employed to improve the machinability or to meet the mechanical properties you need in your bar stock.

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Without obligation please send me your booklet "Extra Services to Users of Cold Finished Steel."

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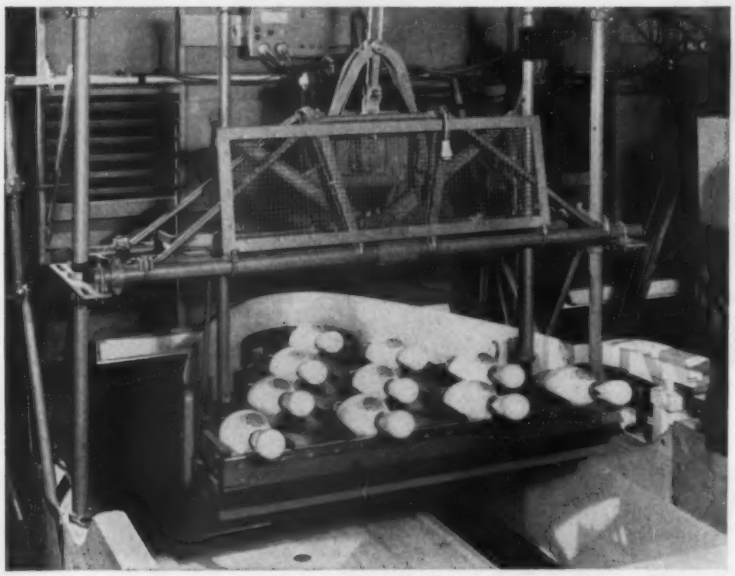
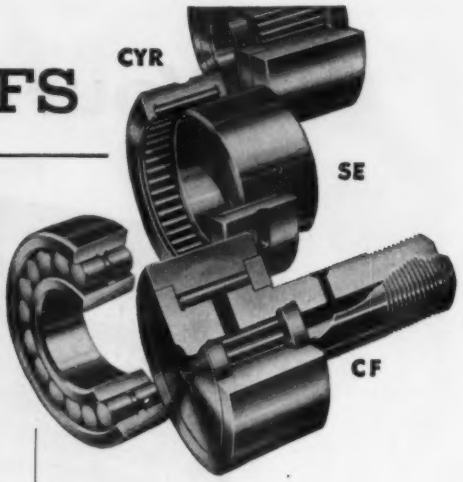
McGILL BEARING BRIEFS





CAMROL CF bearings ADD TO SAFETY of 22,000 Brunswick-Balke-Collender semi-automatic pinsetters now in use

When the pinboys "set 'em up in the other alley" a McGill CAMROL Cam Follower helps them do the job without danger to themselves or damage to the pin-setting machine.

Known as the B-10 Semi-Automatic Pinsetter, this machine is a product of The Brunswick-Balke-Collender Company and is in use on 22,000 individual bowling lanes throughout the world.

In these machines the CAMROL CF bearing is used in the safety latch mechanism to lock the cam action and prevent the machine from recycling during pin setting. Used by the company for 4 years, the CAMROL bearing has given no trouble despite the literally millions of cycles these 22,000 machines have been operated.

CAMROL Cam Follower bearings utilize a full complement of small diameter followers with outer race and integral stud and flange custom heat treated for the ultimate in radial and shock load capacity.

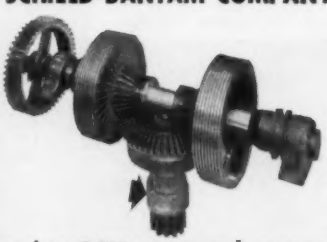
Precision tolerances on all grinding surfaces with simplified lubrication minimizes internal wear and increases bearing life. Both starting and running friction are reduced to a minimum.

McGill designed and built the first Cam Follower and used 20 years of experience with thousands of applications to perfect the right Cam Follower for any cam action application.

BEARING SELECTION GUIDE

A revised 140 page Bearing Selection Guide, complete with 30 pages of vital engineering data, has been released by the McGill Manufacturing Co. Ask for Catalog No. 52.

CAMROL CF BEARING USED from BEGINNING of PRODUCTION by SCHIELD-BANTAM COMPANY



More than 5,500 cranes and excavators built by Schield Bantam since 1945 use CAMROL CF Bearings in SHIFTING COLLAR vertical swing shafts and drum clutch applications. With maintenance negligible and performance excellent the manufacturer asserts, "Using CAMROL CF Bearings offers an overall price advantage and insures maximum product quality."

PINES PRESSURE DIE HOLDER PUTS up to 18,000 POUND LOAD on CAMROL CYR BEARING

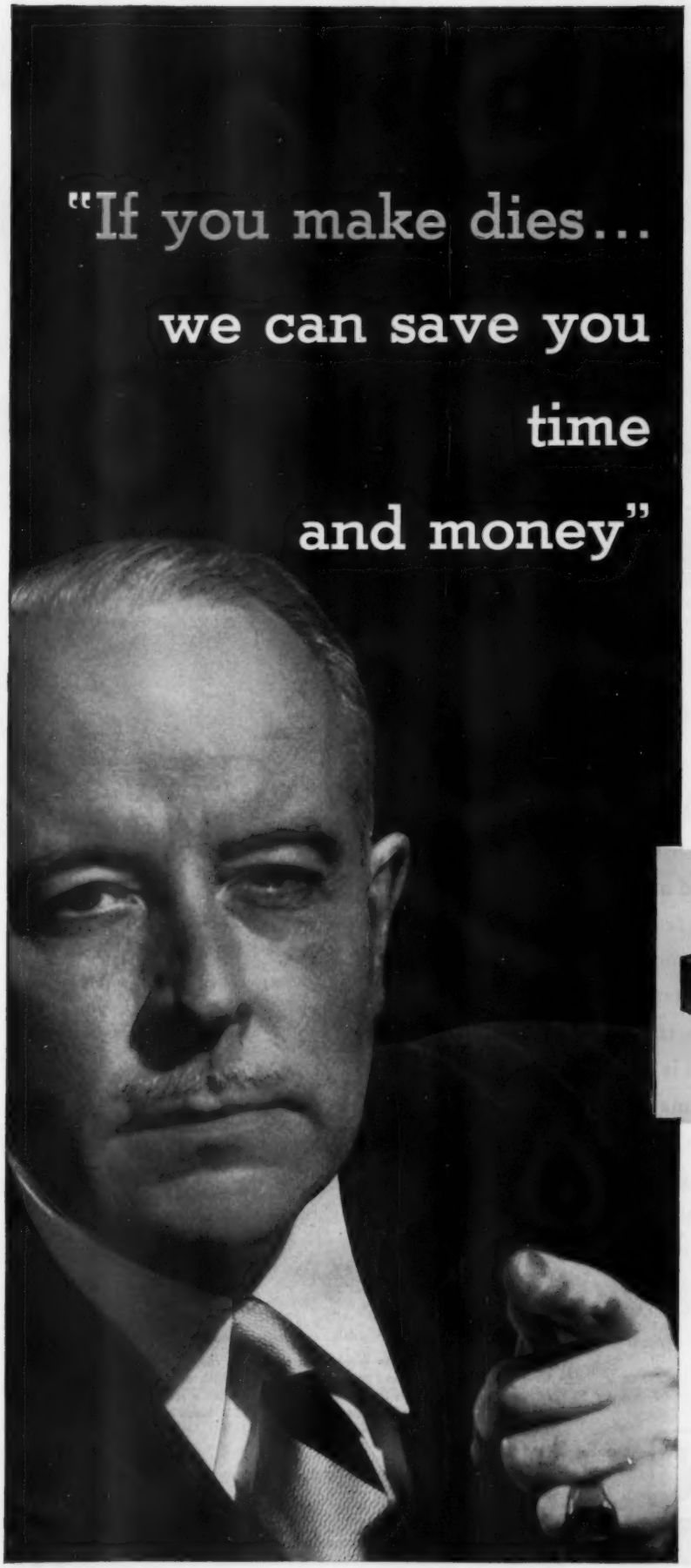
Pines Engineering Co., Inc., has used the CAMROL CYR Bearing for 6 years in tube bending machines and has never had a failure. The bearing takes the full bending moment in Pines pressure die holders that bend extra heavy pipe in sizes ranging from ¾" to 4" without scratching the tubing.

50th Year Anniversary

McGILL design leadership has given you these important developments

★ First full type roller bearing ★ First guided full-type roller bearing ★ First Cam Follower roller bearing ★ First sealed roller bearing

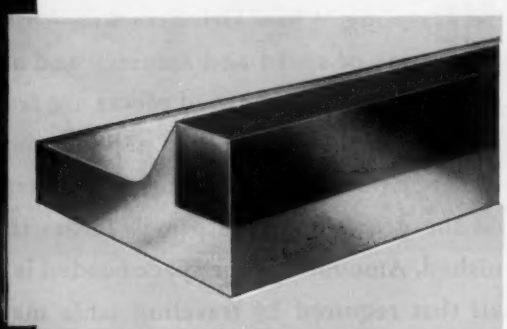
McGILL MANUFACTURING COMPANY, INC., 300 N. LAFAYETTE ST., VALPARAISO, INDIANA



You save time because OK Composite Die Sections are carried in stock ready for immediate shipment to you. They are available for Cutting, Trimming and Forming Dies. You can order them cut to length or in bars 125" long. There are 11 standard cross sections with both wide and narrow lands.

You save money because you can buy them at a price far below what it would cost you to make them yourself. And the soft steel backing, to which uniformly hardened steel is clad, is drilled quickly and economically for dowel and screw holes. Adjustments for wear are equally simple.

Companies now using OK Composite Die Sections report great time and money savings over competitive products formerly used.



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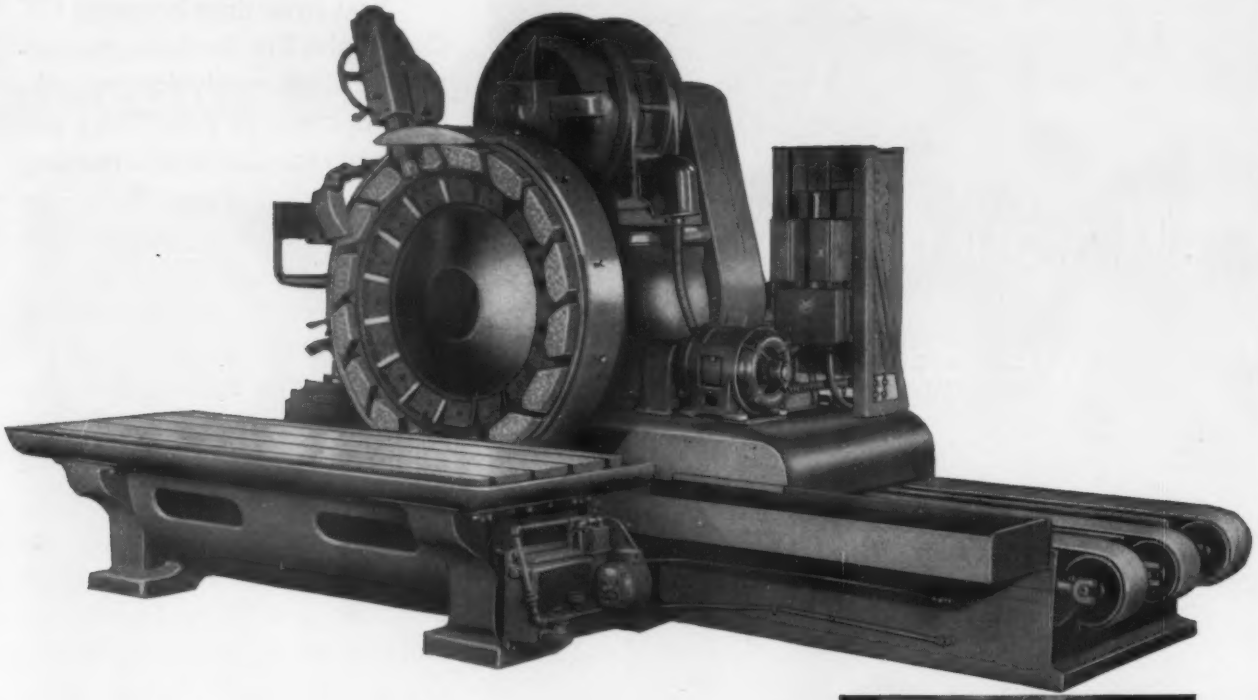
Slitter Knives • Shear Blades Work Rest Blades • Cut-Off Blades • Hardened Spacers Hardened Ways • Gibs • Ball Races • Bronze Ways Wear Strips

The New All Purpose

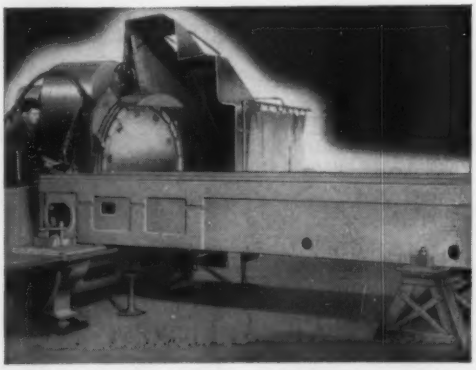


MATTISON TRAVELING WHEEL GRINDER FOR FAST FINISHING OF LONG OR LARGE PARTS

If your work consists of long or bulky parts, Mattison UK Traveling Wheel Grinders will finish them at a surprising rate of speed and accuracy and at very low cost. Large and awkward shaped pieces are frequently ground in a good deal less time than previous method. The part, no matter how large, is clamped in a stationary position and the grinding wheel passes across the surface to be finished. Amount of floor space needed is little more than half that required by traveling table machines of equal capacity. The operator's position on the carriage, together with the convenient grouping of all controls, makes for utmost grinding accuracy and speed regardless of the size of the job.

For further information, send for new free circular No. 844-2 RM covering this machine.

The operator rides the carriage of the UK Traveling Wheel Grinder. From this position he gets a safe unobstructed view of the grinding wheel at point of contact and can observe the work at all times.



Heavy work of practically any length can be rapidly ground to close tolerances with no more power required than for lighter work — the UK's table is always stationary. Picture shows end of 35′ base being ground.

MATTISON MACHINE WORKS
ROCKFORD · ILLINOIS

Webber PRESENTS

The New, All-Purpose, Heavy-Duty 84 Block Gage Set

A COMPLETE GAGING SYSTEM

Here, in a single package, are the 84 gage blocks and the accessories required to constitute a complete gaging system. It will fully meet the exacting requirements of the vast majority of manufacturers of precision products.

Webber Heavy Duty gage blocks are generously proportioned (½" x 1½") in order to insure maximum resistance to wear, with resultant long life. In addition to their normal gaging function, the blocks, used with the proper fixtures, (included in the set) will assemble into dividers, scribers, height or snap gages, thus making them especially valuable for layout or inspection work. When assembled with the required number of six inch blocks, any desired length can be obtained.

84 Block H.D. Set—accuracy, ±.000004", complete with accessories. As illustrated $575.00

84 Block H.D. Set—accuracy, ±.000004", without accessories, with case $495.00

6.000" Block with eccentric clamp $35.75

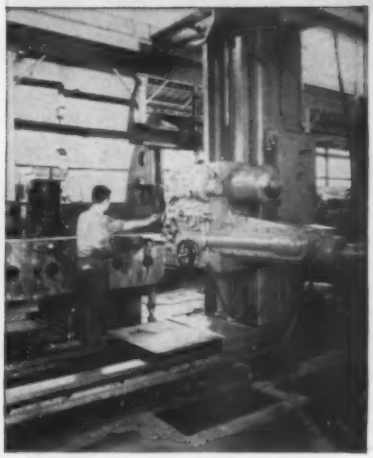
Webber MICRO-ACCURATE Gages

Webber GAGE COMPANY

12901 Triskett Road • Cleveland 11, Ohio

Largest Exclusive Manufacturers of Precision Gage Blocks

Horizontal Drilling Machines by Kaukauna AT WORK....



Performing quick, accurate drilling operations on press frame parts—drilling, fixture boring, tapping operations on milling machine columns—drilling all four parts of a tractor frame on a repetitive production line basis—these are the types of jobs illustrated, showing Kaukauna Horizontal Drilling Machines at work. The time and labor savings are of course apparent—elimination of expensive crane lifts, reduction in handling time, inexpensive tooling.

As illustrated, there is a Kaukauna Horizontal Drilling Machine in a size suitable for any class of work from small, high production jobs to extremely large work pieces. These extremely versatile machines make for greater work simplification and may be used to advantage in your shop for driving boring fixtures, drilling, reaming, boring, counterboring, tapping and spot-facing operations.

Kaukauna builds Universal Radial Drills and Horizontal Drilling Machines in a range of sizes which meet practically all requirements in modern production practice. Write today for descriptive catalog or ask representative to call.

KMC Kaukauna MACHINE CORPORATION
KAUKAUNA, WISCONSIN, U. S. A.

A Versatile Low-Cost Slitting Line

● Production records covering a 3-month period in one plant revealed that one comparatively small, inexpensive Yoder Slitting Line, (No. 2½, 24" wide) had been successfully used on a wide diversity of jobs.

Coil weights ranged from 4082 lbs. all the way down to 80 lbs.; production from 11,135 lbs. down to 629 lbs. per hour, varying with coil size, number of cuts made to the width, and gauge of strip.

The 4th edition of the YODER SLITTER BOOK, just off the press, gives more complete data on each of these jobs, and in addition discusses many subjects bearing on the mechanics and economics of slitter operation, in plants using anywhere from 50 tons per month up to a thousand or more. A copy is yours for the asking. Also estimates and recommendations, without cost or obligation on your part.

THE YODER COMPANY
5519 Walworth Ave. • Cleveland 2, Ohio

Rotary Gang SLITTERS

ENGINEERING YODER MANUFACTURING

From the *American Machinist* Library of *Tips for Top Shop Men*

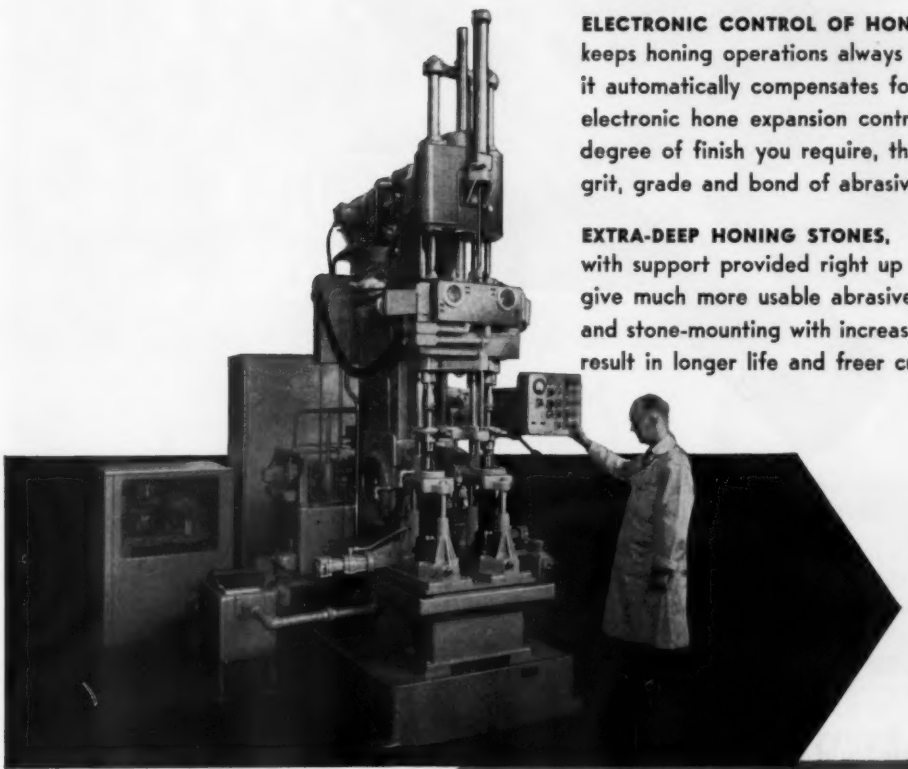
EVERY time you try something new, somebody will call it "a dangerous precedent." Remember that everything new is either wrong or a dangerous precedent to the timid. If you let such reasoning sway you, you'll never do anything new. Only ideas that aren't "dangerous precedents" are the duds.

cut *Finishing* costs
THROUGH HIGH PRODUCTION-PRECISION CONTROL
using
BARNESDRIL

PLUGMATIC SIZING
works automatically to give bore-to-bore size control over every piece honed, making each interchangeable with the others. Sizing is not affected by misalignment or eccentric stone wear.

ELECTRONIC CONTROL OF HONE EXPANSION
keeps honing operations always at peak efficiency because it automatically compensates for stone wear. With electronic hone expansion control, you can select any degree of finish you require, through proper rate of feed, grit, grade and bond of abrasive stone.

EXTRA-DEEP HONING STONES,
with support provided right up to the cutting edge, give much more usable abrasive. Improved body design and stone-mounting with increased cutting edge support, result in longer life and freer cutting action.



No. 307
VERTICAL HONING MACHINE
Job Specifications:
Steel Hydraulic Cylinders
Bore — 3.000" I.D. x 10½" length
.012"/.017" stock removed
Bore Sizing — within .0005"
Finish — 25 R.M.S.
34 pieces per hour

No. 38
HORIZONTAL HONING MACHINE
Job Specifications:
Steel Tubes
Bore — 1.500" I.D. x 10 ft. length
.012"/.016" stock removed
Bore Sizing — within .0005"

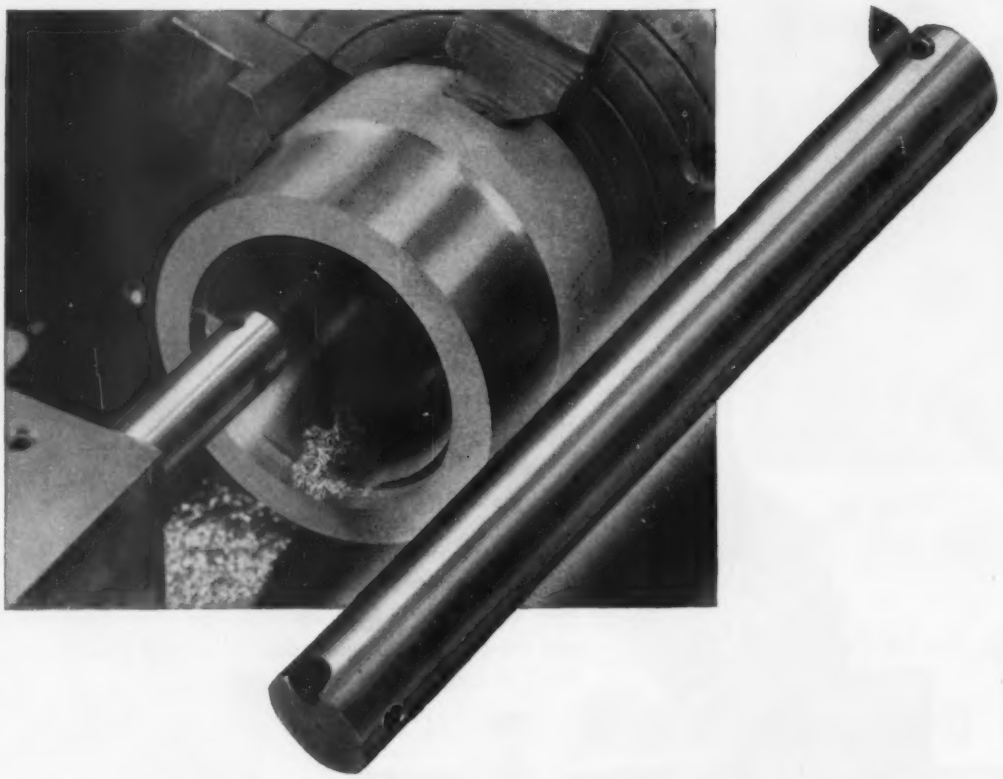
DETROIT OFFICE
3419 South Telegraph Road
Dearborn, Mich.

send for complete catalog bulletin 5004

BARNES DRILL CO.

830 CHESTNUT STREET • ROCKFORD, ILLINOIS

Mallory No-Chat* Boring Bars Can Cut Your Machining Costs



HOW MUCH MONEY and time are being wasted in your shop by chattering tools?

A unique development by Mallory—*No-Chat* boring bars and tool shanks—now puts an end to this waste. Even those tough inside cuts with long overhang of the boring bar can be made with an absolute minimum of tool vibration, and at substantial overall savings in machining cost.

No-Chat boring bars are made of a special high density alloy. Far heavier, more rigid and better heat-conducting than steel, they stop vibration at its source. They cost more . . . but they quickly pay for themselves on the job.

Far more production between grinds. Tools run cooler. Wear due to vibration is drastically reduced. Down time is slashed.

More metal removed per cut. Machines can be set for heavier cuts without danger of chatter.

Cleaner finish. Reduced chatter often eliminates need for finish grinding. You don't cut chips on the way out.

No-Chat boring bars and tool shanks are re-usable. Tips are readily replaced. This unique metal does not anneal, and has no grain-growth problems.

Write to Mallory today for our Technical Bulletin giving full data on *No-Chat*, and available sizes of stock for use in the tools you are now designing.

*Trade Mark
Patent Applied For

Expect more . . . Get more from MALLORY

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Serving Industry with These Products:
Electromechanical—Resistors • Switches • Television Tuners • Vibrators
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For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio

Now! The Oldest Name in Chucks adds Two Great NEW Lines

HORTON CHUCK

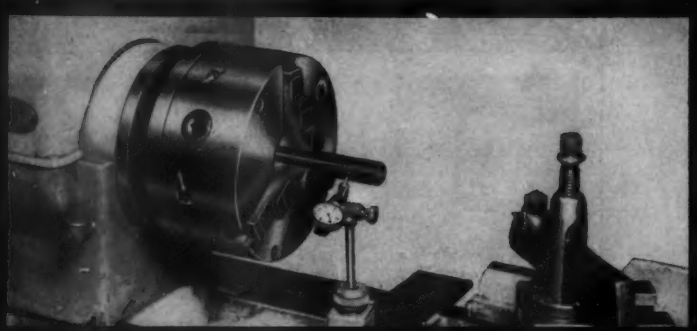
announces

The HORTON

Tru-Set

SELF-CENTERING CHUCK

Adjustable To .0002" T.I.R.



★ Micro-screw adjustment guarantees repetitive accuracy to .0002" T.I.R.
★ Meehanite bodies guaranteed for life.
★ Three operating pinions for instant peripheral location.
★ Available in diameters up to 12" in 3 and 6 jaw styles.

** Both Horton Tru-Set and Windsor Chucks are packed in reuseable airtight metal containers.*

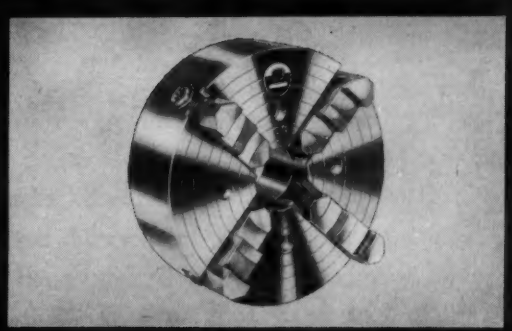
The HORTON

WINDSOR

Medium Duty

MEEHANITE CHUCK

Highest of Quality at a Moderate Price



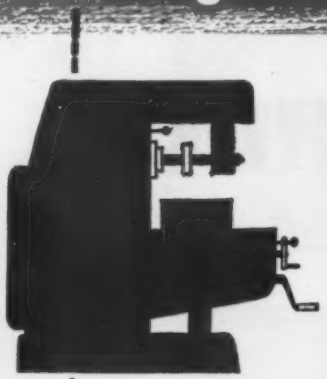
★ Meehanite bodies have tensile strength of 45,000 psi.
★ Scrolls of chrome nickel steel have tensile strength of 134,000 psi.
★ Self-contained operating screws for longer accurate life.
★ Available in stock up to 12" in universal and independent types. Larger sizes on request.

See your Horton Distributor for chucks of quality . . . . and economy.

HORTON CHUCK Since 1851

WINDSOR LOCKS, CONN.

production begins with



Columbus Die-Tool

No tools like the right tools! Columbus Die-Tool designs and builds tools, jigs, fixtures and special machinery to meet your most exacting requirements. RESULTS: operating cost that matches your budget; production that matches your schedule; product quality that matches the demands of your market.

Contact Columbus Die-Tool & Machine Co. first—when you have a special machine problem. They are nationally known as expert designers and builders of special machinery and equipment . . . have been for over 46 years.

Columbus Die-Tool
AND MACHINE COMPANY
P. O. BOX 750 • COLUMBUS, OHIO
ESTABLISHED 1906
Manufacturers of
JIGS • FIXTURES • BUILDING MACHINE TOOLS COMPLETE
SPECIAL TOOLS • UNITS FOR MACHINE TOOLS

WORLD'S HARDEST METAL

BUSHINGS
BLADES
ROLLS
TOOLS
DIES
BAR STOCK
IMPROVED QUALITY
Additional refinements and improvements in our process have added still longer life to the wearing edges of Talide tools, dies and wear resistant parts. The result is a carbide having a new, unique grain structure with harder and tougher properties than previous grades. Laboratory tests reveal our improved grades possess 25% greater strength and rigidity. Service life per grind up to 50% longer than previous grades has been proven in grueling field tests.
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MC
TALIDE®
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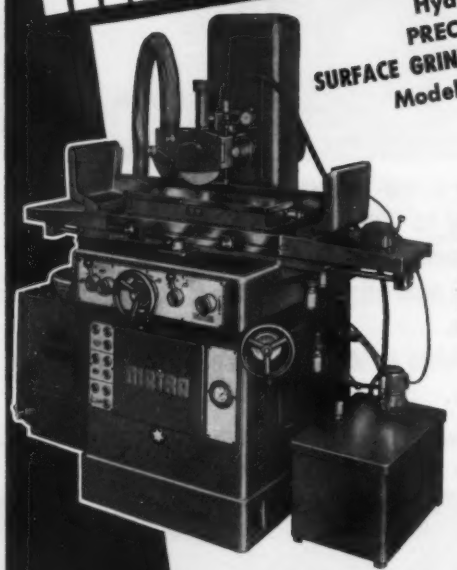
HOT PRESSED AND SINTERED CARBIDES · VACUUM METALS
HEAVY METAL · CERMETS · HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

MATRA

Hydraulic
PRECISION
SURFACE GRINDING MACHINE
Model MF 6



for grinding of:
horizontal and vertical surfaces, slots, keyways, guideways, forms, devices etc.

Please ask for our Special leaflet

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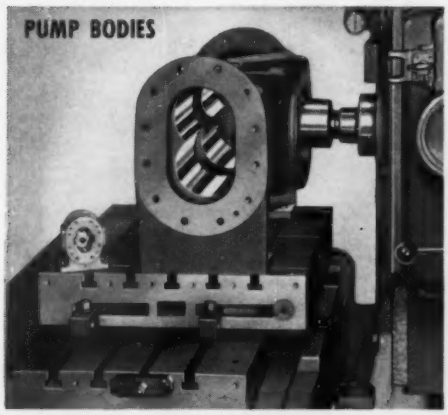
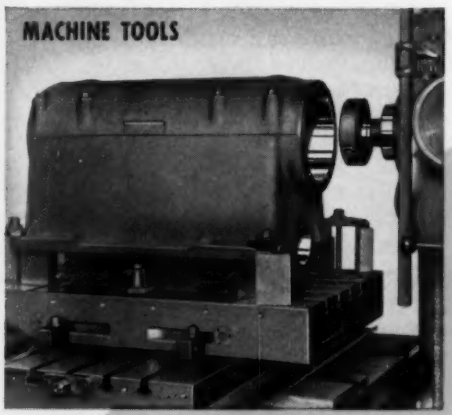
FRANKFURT/MAIN 301
WERKZEUGMASCHINEN UND WERKZEUGFABRIKEN
GERMANY

The DeVlieg System of

*JIGLESS PRODUCTION

. . . eliminates expensive boring jigs!





TYPICAL EXAMPLES OF JIGLESS PRODUCTION ON DE VLIEG JIGMILS

The JIGMIL Technique:

- **ELIMINATES SPECIAL BORING JIGS**
- **REDUCES MACHINING TIMES**
- **PERMITS USE OF SIMPLIFIED TOOLING**
- **IMPROVES ACCURACY WITH RESULTANT CUT IN ASSEMBLY COSTS**

The DeVlieg System of Jigless Production permits complete flexibility of product design!

If your shop is burdened with costly boring jigs and special tooling, it will pay you to investigate the

DEVLIEG *SPIRAMATIC* JIGMIL

Come to Detroit—

see a practical demonstration of the JIGMIL TECHNIQUE

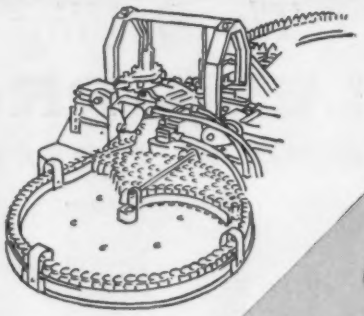
Write for comprehensive Illustrated Catalog

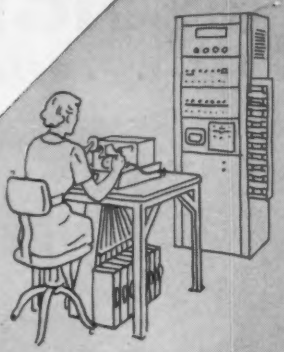
DEVLIEG MACHINE COMPANY • 450 Fair Ave., Ferndale • Detroit 20, Mich.

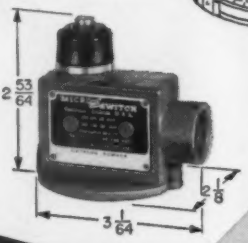
MICRO SWITCH Precision Switches
A PRINCIPLE OF GOOD DESIGN

5 Switches bring smooth operation to this automatic bottle labeler

This machine is designed to label bottles at from 90 to 180 per minute. MICRO SWITCH products were selected to prevent jamming or overload. Factors in their selection were precise, dependable operation, long life, quick response to light operating force and sealed plungers to keep out dirt and dust. Perhaps you need a switch to give a new "lift" to your new product. Take the short cut. Ask MICRO SWITCH engineering. There's no obligation.

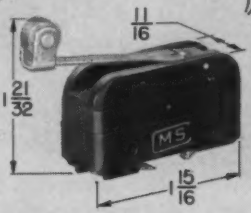






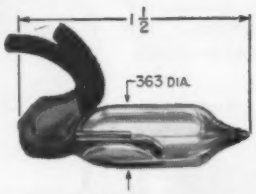
If it's switches . . .
precision switches . . .
DON'T EXPERIMENT

MICRO SWITCH has saved years of design and engineering time on such applications as these



2 switches help electronic gage sort small parts at from 60 to 120 per minute

Here's an electronic gage that sorts eight sizes of manually-loaded mica parts at high speed. The two switches are operated by timing cams and control the steps of the gaging cycle. The extremely accurate repeat operation of the MICRO SWITCH switches at high speed and for long periods of time was an important factor in their choice. There is a *right* switch for your application. Save your design and engineering time. Call MICRO SWITCH.



A Honeywell Mercury Switch gives trouble-free, dependable light control in lid of food freezer

Hidden in the lid of this food freezer, unaffected by the extreme cold or temperature variations, is this small HONEYWELL Mercury Switch. It operates by the action of tilting the freezer lid. If your application provides tilt motion and requires low operating force, it may be that a mercury switch is the best for you. Whatever your switch problem, MICRO SWITCH can provide the proper switch.

A complete line of snap-action and mercury switches

MICRO SWITCH provides a complete line of extremely reliable, small-size, high-capacity, snap-action precision switches and mercury switches. Available in a wide variety of sizes, shapes, weights, actuators and electrical characteristics. For all types of electrical controls.

MICRO SWITCH
A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY
In Canada, Leaside, Toronto 17, Ontario • FREEPORT, ILLINOIS

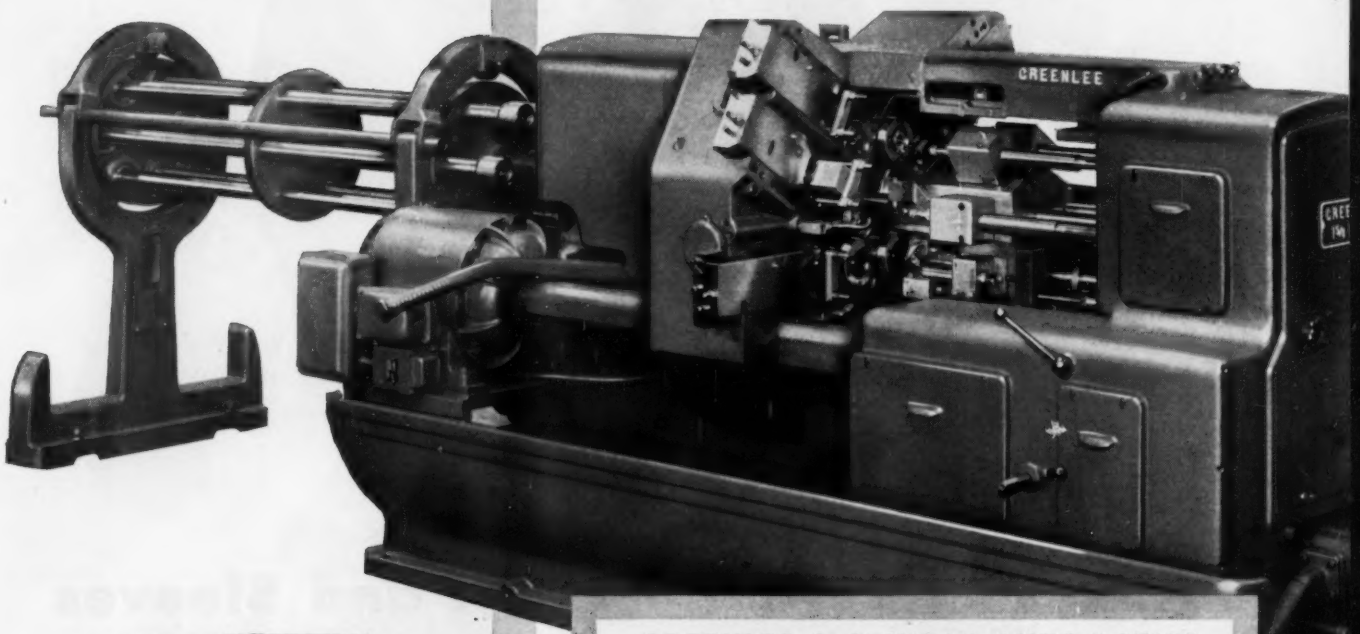
H HONEYWELL

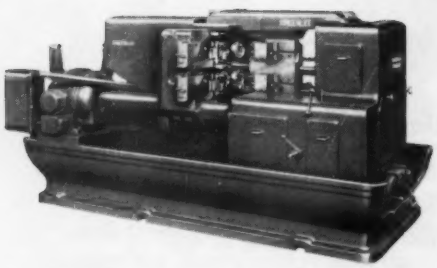
PRODUCTION MACHINERY
GREENLEE

AUTOMATIC BAR MACHINES

INCREASE YOUR PRODUCTION... LOWER YOUR COSTS!

CUT YOUR SET-UP TIME
SPEED-UP DIFFICULT OPERATIONS





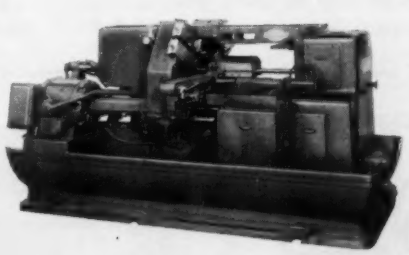
GREENLEE 6-SPINDLE AUTOMATICS
SPECIFICATIONS

Rating	1"	1-5/8"	2"
Chuck Capacity, Round	1"	1-5/8"	2"
Chuck Capacity, Hexagon	7/8"	1-13/32"	1-3/4"
Chuck Capacity, Square	3/4"	1-1/8"	1-7/16"
Stock Feed	6-3/16"	8-5/16"	8-5/16"
Turning Length	6"	7-1/2"	7-1/2"
Spindle Speed Range	225 to 2500	105 to 2175	95 to 1935
Feed Range per Spindle Rev.	.0014 to .0218	.0017 to .0388	.0019 to .043
Motor Horsepower	15	20	25
R. P. M.	1800	1800	1800
Floor space:			
Length with Stock Reel	17'-6"	17'-3"	17'-3"
Width	5'-0"	5'-4"	5'-4"
Height	4'-11"	5'-4"	5'-4"
Net Weight in Pounds	14,400	17,940	18,150

GREENLEE 4-SPINDLE AUTOMATIC
SPECIFICATIONS

Rating	2-5/8"
Chuck Capacity, Round	2-5/8"
Chuck Capacity, Hexagon	2-1/4"
Chuck Capacity, Square	1-7/8"
Stock Feed	8-3/16"
Turning Length	7-1/2"
Spindle Speed Range	120 to 1200
Feed Range per Spindle Rev.	.002 to .0458
Motor Horse Power	20
R. P. M. of Motor	1800
Floor Space:	
Length with Stock Reel	17'-3"
Width	5'-4"
Height	5'-0"
Net Weight in Pounds	17,000

GREENLEE 2ND OPERATION AUTOMATIC



Extremely versatile, high-production machines. Parts can be loaded semi-automatically or fully automatically. Incorporates the same basic features . . . inherent production and operating advantages as the standard 6-Spindle Automatics.

INVESTIGATE NOW
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PRODUCTION MACHINERY
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GREENLEE BROS. & CO.
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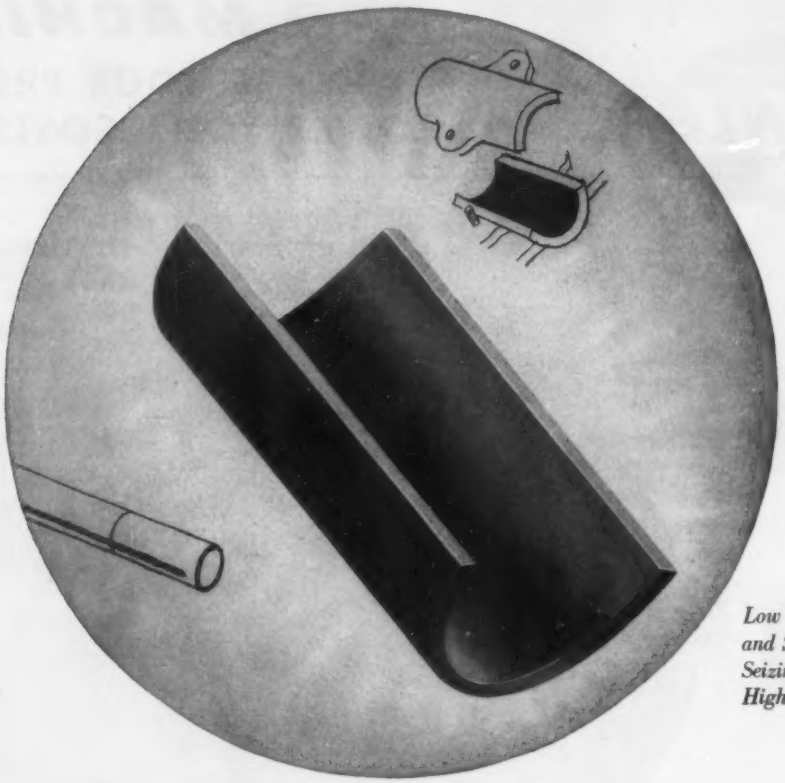


Low Friction Bushings and Sleeves Resist Seizing, Abrasion, High Temperatures

HAYNES STELLITE Bushings and Sleeves

Trade-Mark

...for handling Hot-Abrasive Materials

Bearing parts made of HAYNES STELLITE alloy resist seizing and galling. They are hard and abrasion resistant, and will withstand the pitting effects of many corrosives. They take a high polish and are easy to apply. Use them to reclaim worn shafts or bearing blocks, and to lengthen the life of new equipment.

Operate with Little or No Lubrication

Sleeves made of HAYNES STELLITE alloy can be used in areas where efficient lubrication is impossible. They resist seizing even when lubricants are diluted by gasoline, cleaning fluids, and other liquids that wash out an oil film. They operate at peak efficiency even when lubricants decompose under heat, or are destroyed by abrasive particles.

Tough and Abrasion-Resistant

Bearing parts made of HAYNES STELLITE alloy resist the abrasive effects of wet or dry materials such as fly ash, coke, metal powder, shale, and cement dust. They are hard enough to carry heavy loads, and tough enough to stand up under repeated stress.

Heat and Corrosion Resistant

These bushings and sleeves can be submerged in many acids, alkalies, and molten metals. Temperatures as high as 1500 deg. F. have little effect on their hardness, toughness, and dimensional stability.

For more information write for our 8 page booklet on half bushings and sleeves.

"Haynes" and "Haynes Stellite" are registered trade-marks of Union Carbide and Carbon Corporation.

HAYNES TRADE-MARK ALLOYS

HAYNES STELLITE COMPANY

A Division of Union Carbide and Carbon Corporation

UCC

General Offices and Works, Kokomo, Indiana

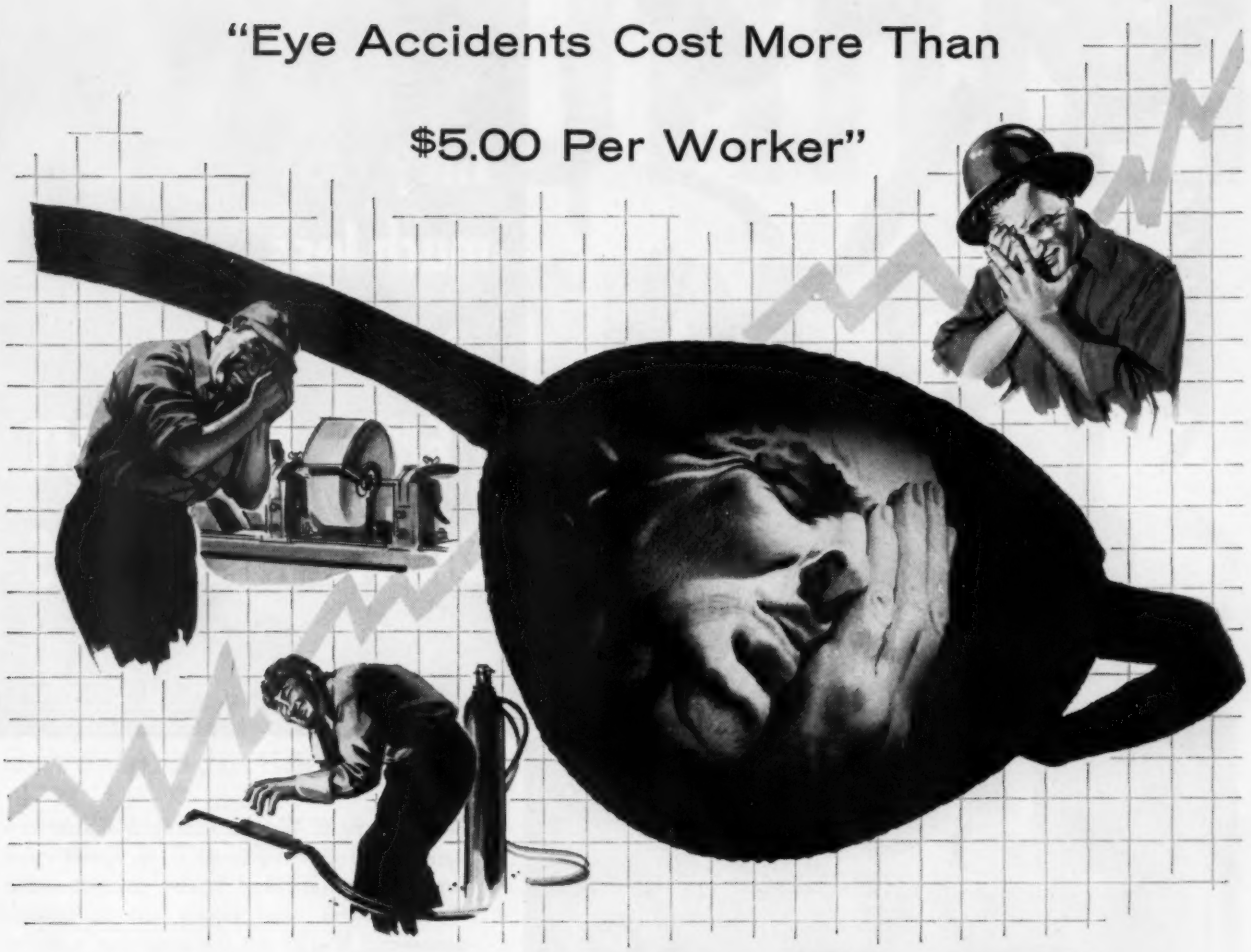
Sales Offices

Chicago • Cleveland • Detroit • Houston • Los Angeles • New York • San Francisco • Tulsa

We've been saying

"Eye Accidents Cost More Than

$5.00 Per Worker"



One Industry Has "Had it" up to $30,528 per Accident

In studying the costliness of eye injuries, one industry discovered that the Workmen's Compensation Laws awarded $30,528 for complete loss of vision and $7,700 for partial loss. Eye-hazardous operations included chipping concrete, operating machine tools (both woodworking and metalworking), using hand tools (both power and manually operated), using compressed air and the various burning, cutting, welding and brazing operations.

How about *your* industry — and *you?* As against a two, three, four and even five figure eye accident cost, the average safety goggle costs only $2.30 (and it prevents 98% of industrial eye accidents).

Where can you get a better return on your investment? For full details, including savings on lowered insurance costs, savings on idle machine charges and other benefits of an AO† Eye Protection Program, write American Optical Company, 5134 Vision Park, Southbridge, Mass. Or ask an AO Safety Representative to call.

For the *finest* in protection — look for the AO monogram on safety lenses and frames.

American Optical

SAFETY PRODUCTS DIVISION

†T. M. REG. BY AMERICAN OPTICAL COMPANY

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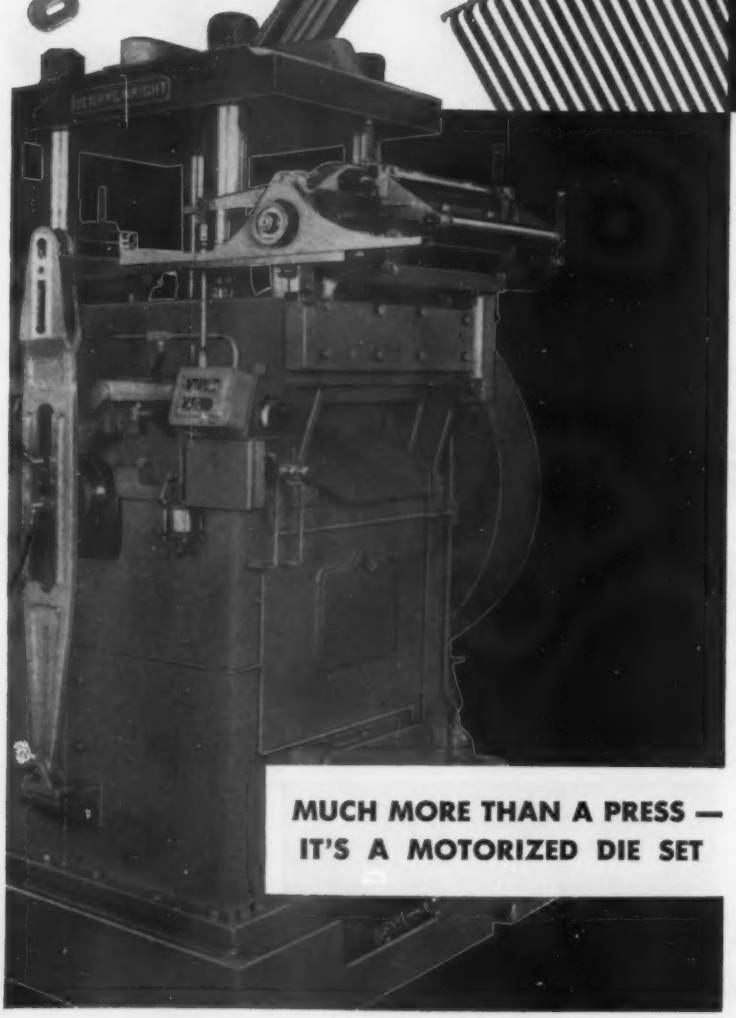
they cost much less to make on HENRY & WRIGHT DIEING MACHINES



Each Henry & Wright Dieing Machine is a versatile production unit. Want speed alone for straight blanking? You've got it to spare. Want to form, bend, fasten with dependable accuracy? You've got the precision, rigidity, and endurance in the Henry & Wright Dieing Machine to cope with the most difficult progressive jobs. You're ready for any stamping job with Henry & Wrights — *get full details by writing Henry & Wright, Division of Emhart Mfg. Co., 481 Windsor St., Hartford, Connecticut.*

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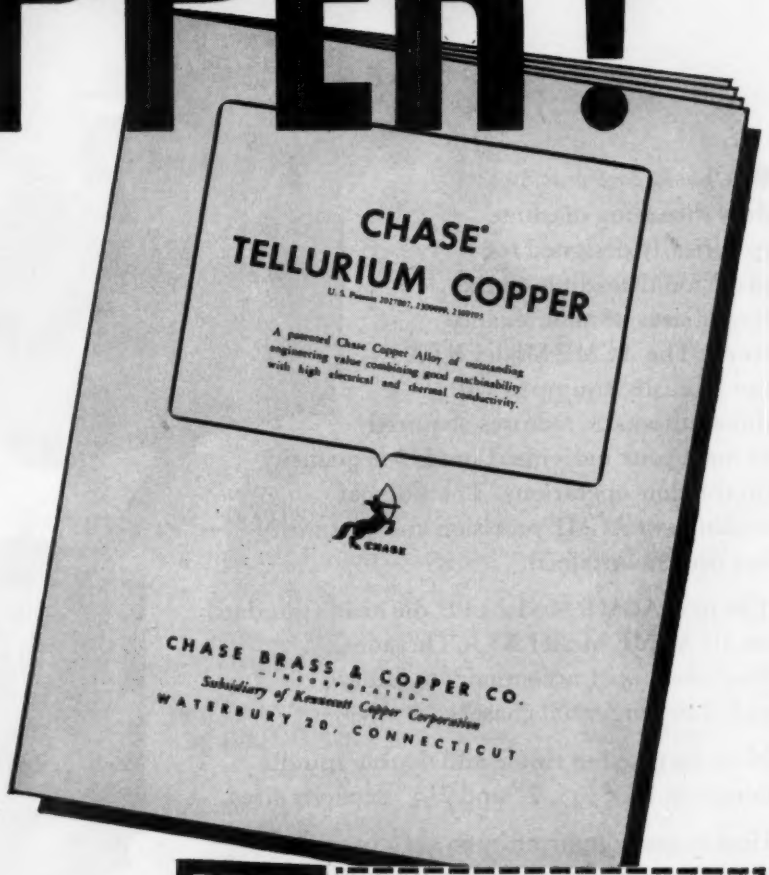
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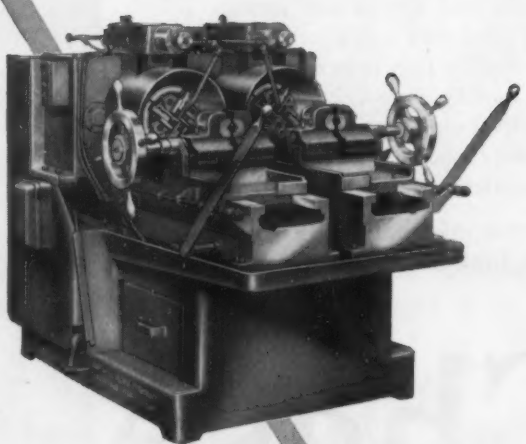

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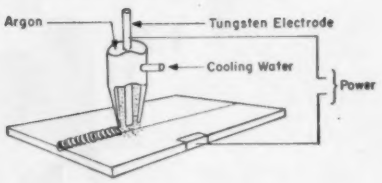

Each of the six appendages of these 52S aluminum aircraft manifolds is HELIARC welded to the tubular main section in from 20 to 45 seconds . . . The spatter-free, flux-free HELIARC welds need no cleaning or finishing—costs are kept at a minimum.

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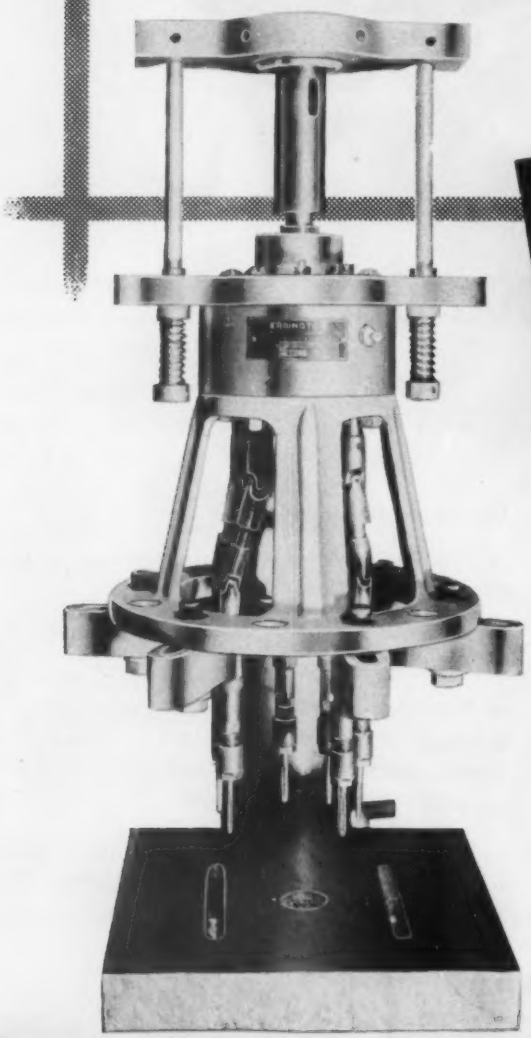

LESS THAN ½ MINUTE TO CHANGE HEAD FROM DRILLING TO TAPPING OR TAPPING TO DRILLING

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Min. centers 11/16"
Max. Pattern 5¼"

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Min. centers 1½"
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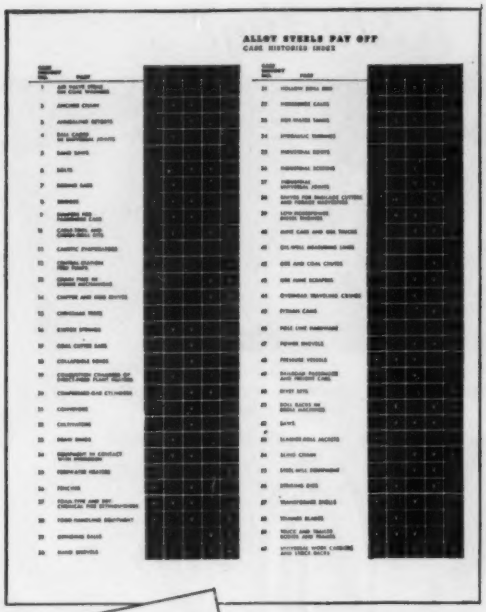

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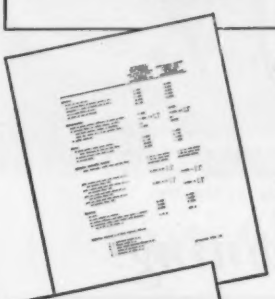
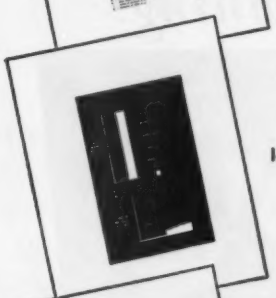
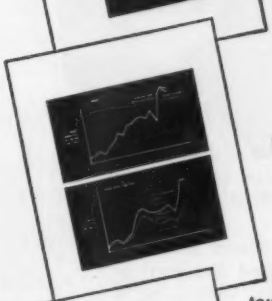


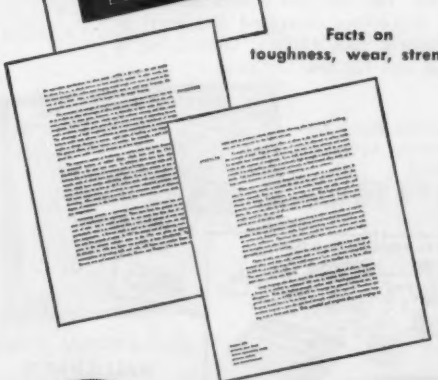
Facts on maximum pay load



Facts on lower operating costs



Facts on lower corrosion rate



Facts on toughness, wear, strength

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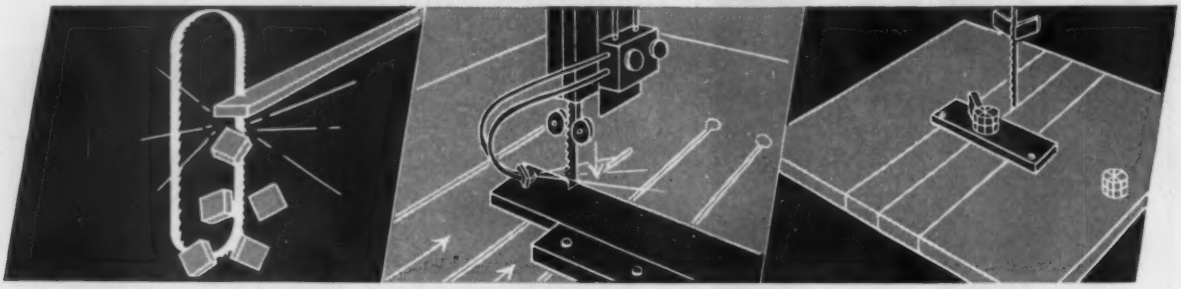
***Advantages of ALLOY STEELS**

- longer life
- greater pay load
- lower operating costs
- greater safety
- less maintenance

CLIMAX MOLYBDENUM

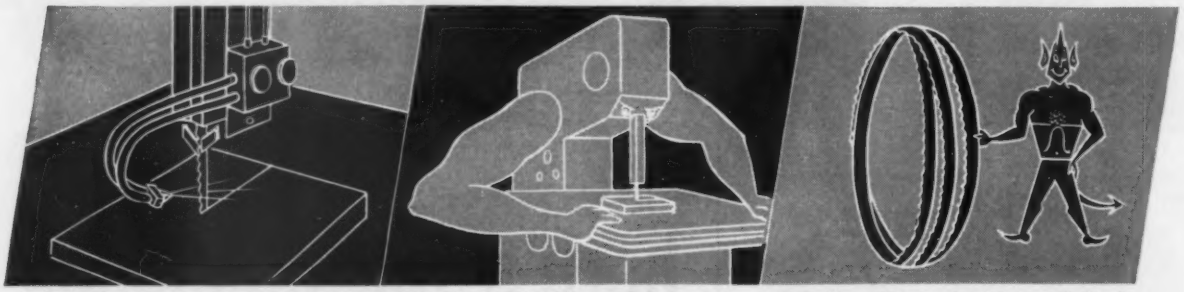
Formula for Production Cost Reduction...



+ 1. *The Speed of Band Machining* — continuous cutting action of 1000 to 1500 teeth.

+ 2. *Hydraulic Power Feed Table* — automatically carries the work into the continuous cutting blade.

+ 3. *Simple Clamps or Fixtures* — just to hold the work in position on the hydraulic feed table.



+ 4. *Integral Recirculating Coolant System and Air Jet*—for faster cutting and excellent finish.

+ 5. *Massive Rigidity and Extra Power* — for extreme accuracy and high continuous output.

+ 6. *New "Demon" High Speed Steel Blades* — up to 6 times faster cutting and 10 times the tool life.

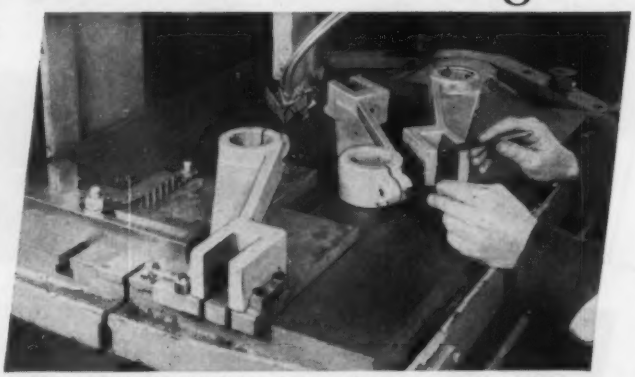
...*Mass Production Band Machining!*

MANY production line machining operations such as slotting, splitting, notching, cutting to shape now being done on milling machines, shapers, planers, lathes can be done at ⅓ to ½ the cost with DoALL production band machining. The formula above shows you why.

With band machining, cutting is faster, tool cost is lower, fixturing costs less, capital investment is less. Greater versatility is provided by the "non-restricted geometry" of band machining—cut any angle, any direction, any radius.

This new concept of machining has been made possible by new DoALL Contourmatic band machines, and new "Demon" *high speed steel* blades.

You have to see it to appreciate it. Ask a DoALL man to show where you can apply it.



53% TIME SAVING in slotting bronze castings with band machining—formerly done with a slitting saw on a milling machine.

FREE DEMONSTRATION. You can see it and believe it! Call your local DoALL Store (see classified directory) or write **The DoALL Company,** Des Plaines, Illinois, for a free demonstration. And, ask for new Catalog.

PB-12

DoALL

NEW COLOR FILM—"Production Band Machining" now available showing operation of this new machining concept.

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Quick, aggressive use of the tax dollars you save on fast depreciation can finance new machines—pump new life and profits into your whole operation.

C.I.T.'s PAY-AS-YOU-DEPRECIATE PLAN is the key to capitalizing on your new faster depreciation allowances. Here's why:

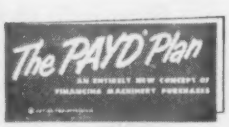
1. You use minimum amounts of your liquid cash.
2. We arrange repayment schedules which tie in closely with your Sum-of-the-Digits depreciation allowances.
3. You enjoy longer terms.

In short PAYD PLAN combines fast depreciation and new machinery financing to your advantage.

PAYD PLAN is solving equipment purchase problems and making new profits possible in many industries. It covers such categories as machine tools, material handling equipment and construction equipment.

Terms range from six to ten years. The PAYD PLAN charge is 4.25% for each year of the term, computed on the original unpaid balance.

New PAYD PLAN folder describes how you can put new machinery to work right away. Just write, we'll send it without obligation.



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TAPPING ATTACHMENT
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Enthusiastic comments like those above have been coming in every day ever since we introduced the new high-speed, super-sensitive Ettco-Emrick Tapper.

And why not? The new Ettco-Emrick Tapper incorporates the most revolutionary advancements in tapping attachment design in years. All parts run in a sealed oil bath—resulting in greater sensitivity, longer life, and better performance. It's the one tapper that really meets today's demand for higher accuracies, closer tolerances, and faster, easier operation.

Light-weight, compact, rigid, sensitive and cool-running, it has an in-built and lasting accuracy which far exceeds every day tapping requirements.

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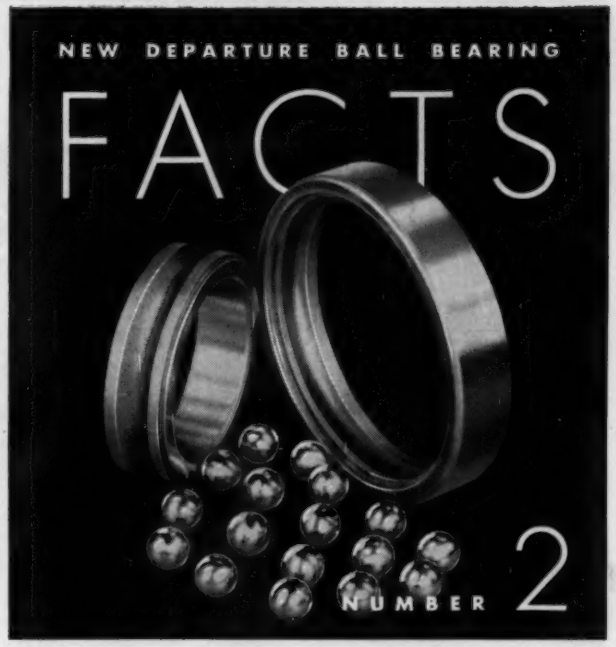
END MAINTENANCE PROBLEMS

with Bearings "Built to Be Forgotten!"



When machine design calls for bearings in inaccessible places, serious maintenance problems often arise. Disassembly for bearing replacement or adjustment is usually costly in both man-hours and lost production. Much the same holds true for many consumer products that must take use and abuse, yet operate efficiently over long periods.

BALL BEARINGS THE SOLUTION

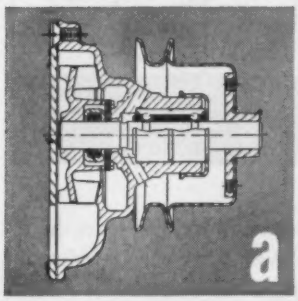
Fortunately, the engineer today has a ready answer at hand. Because of certain unique advantages, ball bearings are ideal in virtually all cases. Ball bearings are permanent, fixed units. When properly enclosed they operate over extremely long periods with practically no wear. Thus, the various parts of the bearing retain their accurate interrelationship. In effect, this means that ball bearings are the most practical of all anti-friction bearings to fit with permanent seals. Lubricant can be enclosed for lifetime operation in many services.

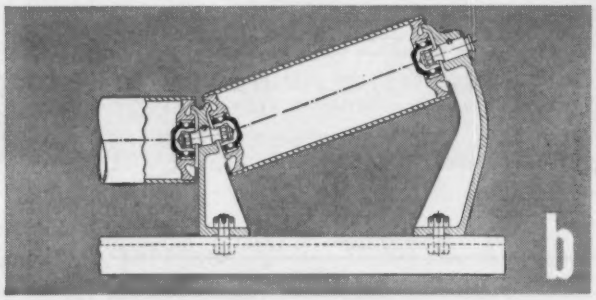
THE SEALED-FOR-LIFE BEARING

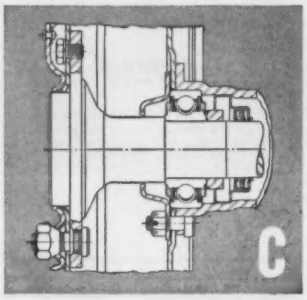
The most logical choice in applications such as those outlined is New Departure Sealed-for-Life bearings. This great advance in bearing design was originated and developed by New Departure. More than 266 million of these bearings have proved their value in service.

In case after case, New Departure Sealed-for-Life bearings have cut maintenance costs to the zero point. Truly, they are *"built to be forgotten"!*

Consult with New Departure on your bearing problems. You will find the experience gained through more than 50 years of designing, testing and manufacturing bearings a major assistance.







A. The automotive fan and pump shaft bearing originated by New Departure demonstrates advantages of the sealed-for-life principle. This bearing has eliminated all the old water pump troubles and service. It requires no relubrication or adjustment. It has proved that it is "built to be forgotten," through use in cars and trucks everywhere.

B. Conveyor roll units constructed around New Departure conveyor bearings require remarkably few parts. Bearings are sealed and lubricated for life. Savings in labor and lubricant are most pronounced. Units with these bearings are economical to produce and easy for the operator to set up. They also are "built to be forgotten."

C. The New Departure rear wheel bearing has made it possible for the engineer to design the simplest, strongest and most foolproof of mountings. This permanently sealed bearing requires no adjustment or relubrication. Grease gun fittings are eliminated. It is famous because it has demonstrated in millions of rear wheels that it needs no attention . . . it can be forgotten.

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN.

Send for Booklet D-7 on sealed ball bearings

NEW DEPARTURE
BALL BEARINGS

NOTHING ROLLS LIKE A BALL

Logan Air-Draulic®

FEED CONTROLLED CYLINDERS

Combine The Fast-Acting, Economical Low-Pressure Operation Of ..... **AIR**

With The Smooth, Uniform Controlled Regulation Of ..... **OIL**

... for Pushing, Pulling, Pressing, Clamping, Holding, Lifting, and Other Power Movements In Any Direction

Air-Draulic Cylinder with Plunge Mounting at Rod End

5 STANDARD MOUNTING TYPES

Standard bores from 3" to 6". Any stroke to 5'. For air pressure to 150 psi. Power movement in any direction. No power unit required. Heads as low as 1,150 lpm; lower speeds special on request.

NO POWER UNIT REQUIRED

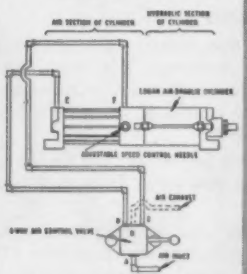
Basically, Logan AIR-DRAULIC® Cylinders are *air cylinders*, and may be used wherever compressed air is available. Yet they provide the smooth, uniform, controlled feed which is normally obtained only in *hydraulic cylinders*.

Reduced to its simplest terms, the Logan AIR-DRAULIC Cylinder is an integral unit consisting of an air piston and a hydraulic piston mounted on a single rod. The thrust or pull of the rod is obtained by means of the air cylinder, controlled by a valve or valves in the usual manner. The two chambers in the hydraulic cylinder are connected externally in a self-contained circuit; an adjustable speed control valve in this circuit regulates the flow of oil and hence the speed of the rod stroke.

Rapid return is made possible by a check valve in the hydraulic piston, permitting unobstructed oil flow on the return stroke. *Controlled feed in both directions* is also available by omitting the check valve. *Skip-feed* can be obtained through the use of cam valves applied externally in the hydraulic circuit.

The hydraulic circuit is self-contained, and no power unit is required. Logan AIR-DRAULIC Cylinders can be equipped with an automatic oil filler if desired.

Member—National Tool Builders Assn.
National Fluid Power Assn.



Basic AIR-DRAULIC Circuit with 4-Way Control Valve No Power Unit Required

HOW TO INSTALL AIR-DRAULIC CYLINDERS

The basic circuit for installation of Logan AIR-DRAULIC Cylinders is shown at the left. The air section of the cylinder is connected in the same manner as a standard double-acting air cylinder, a 4-way air control valve, piping and a connection to the main air line being required. A hand-operated air valve is illustrated, but foot-operated or other types of air valves may be used. The hydraulic section of the cylinder is a self-contained circuit and requires no additional equipment or connections.

Piping is arranged from ports B and C on the air valve to ports E and F, respectively, on the air section of the AIR-DRAULIC Cylinder. Port A is the air inlet port and port D the exhaust.

The desired piston speed is obtained by setting the adjustable needle on the hydraulic section of the cylinder. Controlled speed may be obtained on the out-stroke, the in-stroke, or both, through the internal arrangements of the hydraulic cylinder.

Let Logan engineers help you design your Air and Hydraulic Circuits. No obligation.

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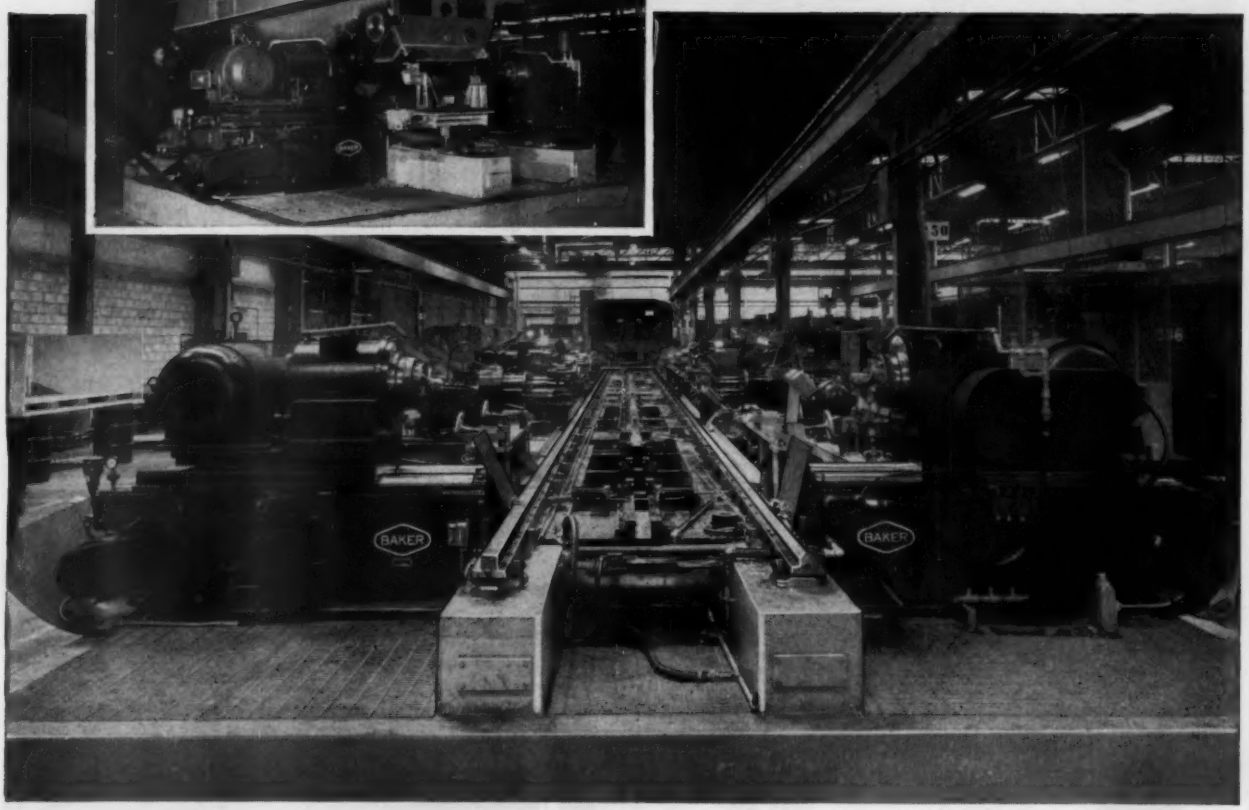

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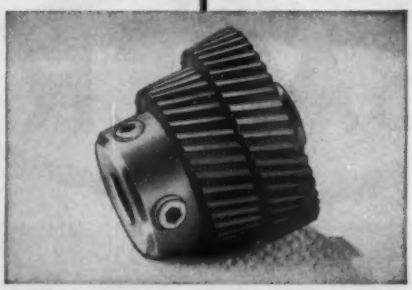

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FILTRATION DIVISION

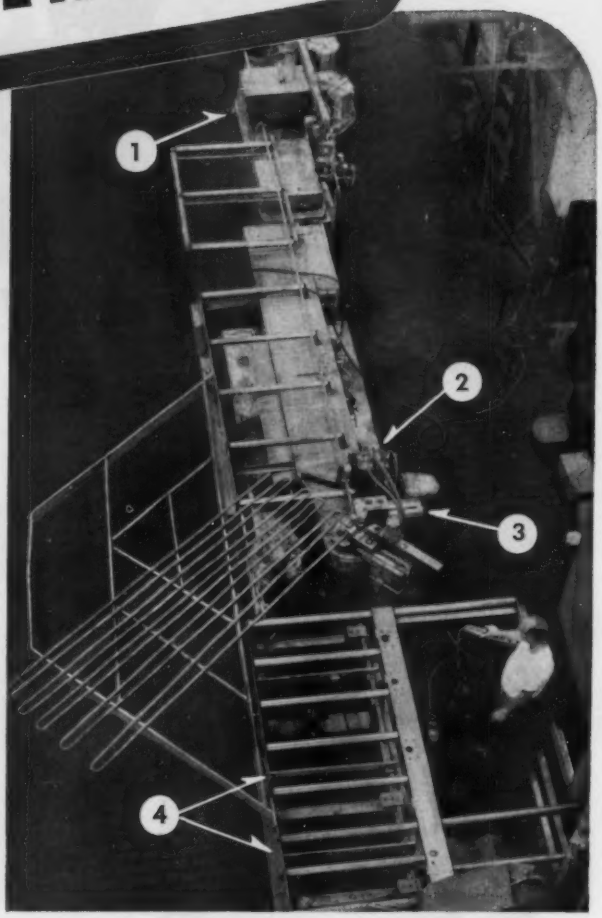
Automation IN COIL BENDING

How Serpentine Coils Are Now Produced in One Continuous Operation on PINES Size 1¼ Production Bender

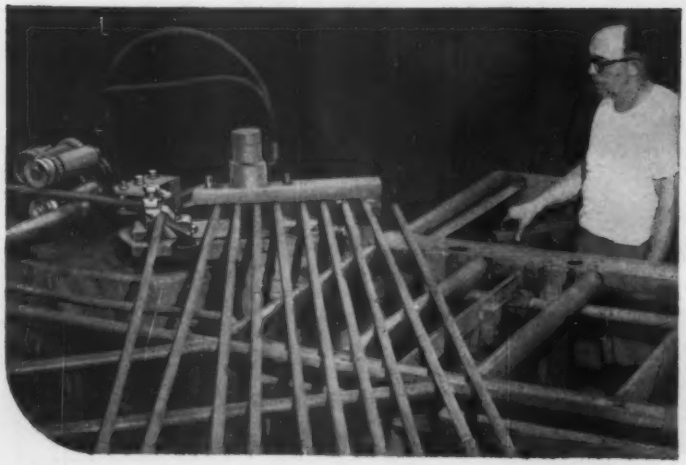
● At Carrier Corporation, Syracuse, N. Y., large serpentine air conditioning coils are now completely formed in one, continuous bending operation on a Pines Size 1¼ Production Bender equipped with a flash welder, automatic feed roll, and turn-over fixture. By former methods, three machines were required to meet production needs, and after bending, from 64 to 128 welds were necessary to fabricate a complete cooling unit. In addition to the slow, inconvenient welding procedure, a considerable amount of stock cutting and work handling was required.

COILS NOW PRODUCED AT 200 BENDS PER HOUR

Today, with the new Pines equipment, complete serpentine coils are now formed with little work handling. Straight lengths of stock are butt-welded together before bending which permits completing the coils in one, continuous operation. This method reduces the number of welds and stock cutting because long lengths of stock are used. Scrap losses are reduced as much as 80%, and since the entire operation is mechanized, work handling is substantially reduced. The result — complete coils are now produced on one machine with two operators at a production rate of 200 bends per hour.



▲ Over-all view of Pines installation at Carrier Corp., Syracuse. Handles standard pipe ranging from ¾" up to 1¼" sizes. The unit combines (1) welder, (2) feed roll, (3) bender, and (4) turn-over fixture.



◀ Closeup view showing automatic feed roll and tooling. Hinged clamp die with angular cam surface and mating plate permits clamping workpiece without interfering with formed coil. Long, horizontal clamp holds ends of coils to prevent distortion during sweep of bending arm.

WRITE FOR *Free* DATA SHEETS

For more information on latest developments in production bending, write for copies of "Pines News". Describes and illustrates how production bending is helping cut manufacturing costs on a wide variety of jobs.

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Specialists in Tube Fabricating Machinery · 672 WALNUT • AURORA, ILLINOIS

PRODUCTION BENDING • DEBURRING • CHAMFERING MACHINERY

A revolving fixture holds this tubular steel chair-desk while the weldor brazes the joints with ANACONDA-997 (Low Fuming) Bronze Welding Rod. Heywood-Wakefield Company began producing welded steel tubing back in 1910. Today, they are leading manufacturers of tubular steel schoolroom furniture, bus, subway, railway car and theater seating.

here's production speed . . .

23 braze welds in 17 minutes

Here's the finished chair with seat, back rest and desk sections in place.

They know a lot about the techniques of production welding at Heywood-Wakefield Company, Gardner, Mass. Take the combination school chair-desk you see here. First it's tack-welded by semi-automatic resistance welding. Then it goes into a revolving fixture for braze welding with ANACONDA-997 (Low Fuming) Bronze Welding Rod and the flame-fluxed oxyacetylene process. The weldor swings the assembly to reach all joints from one position, completing the 23 welds in an average time of 17 minutes.

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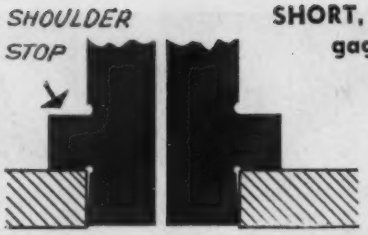

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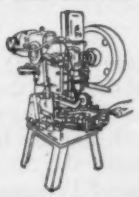

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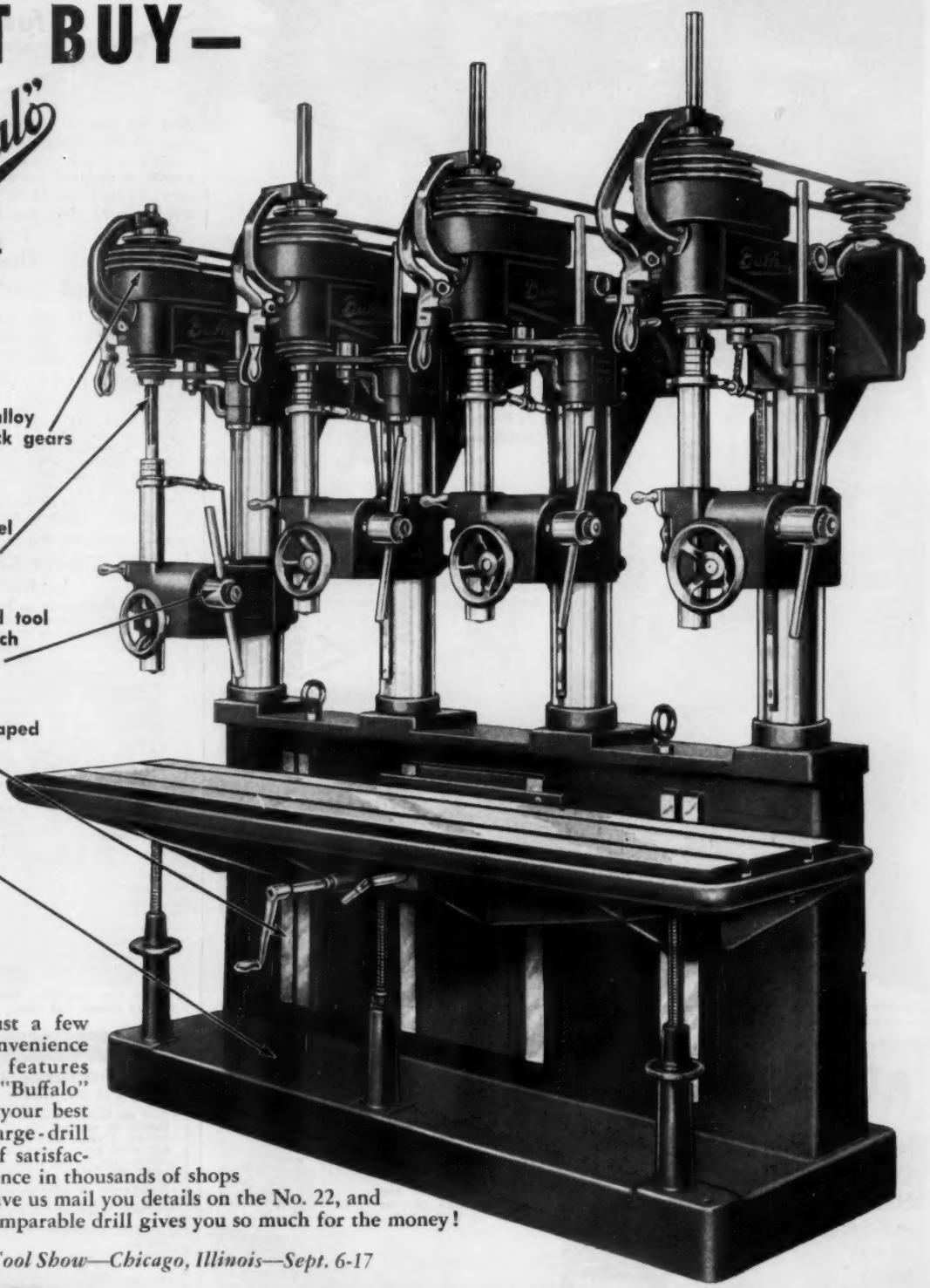
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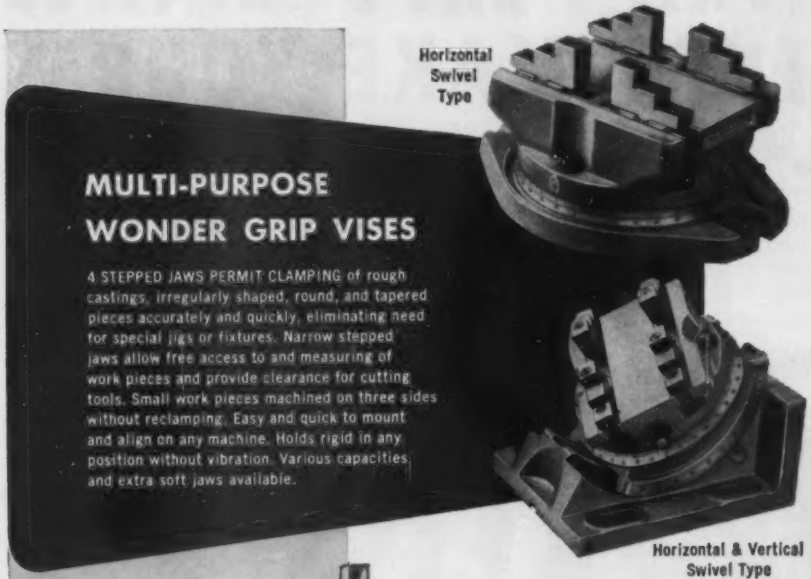

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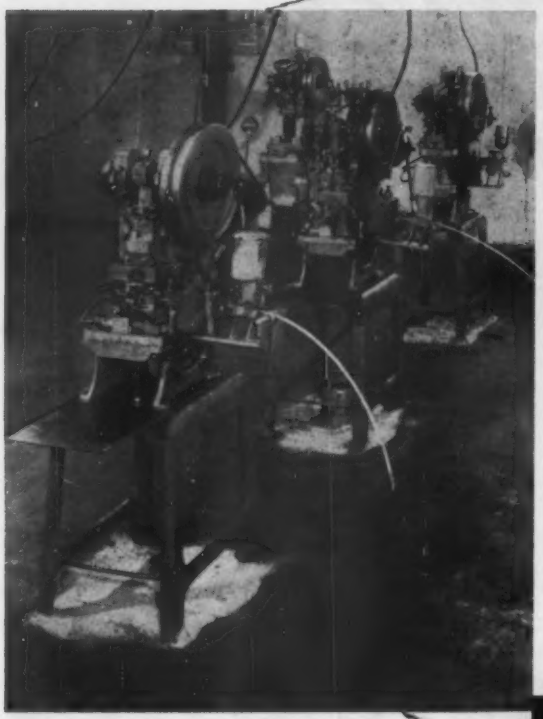

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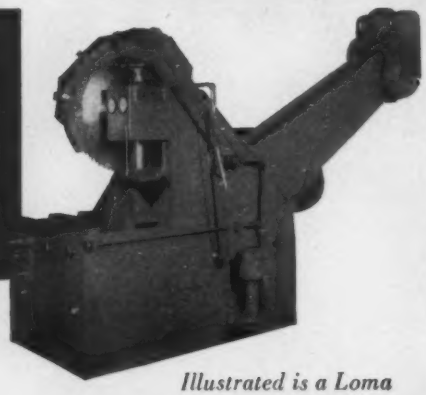

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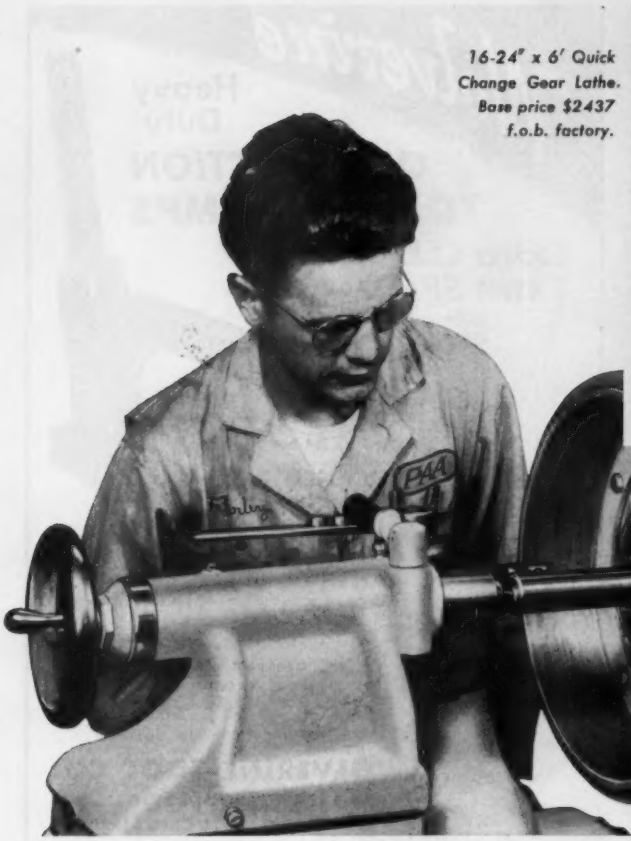

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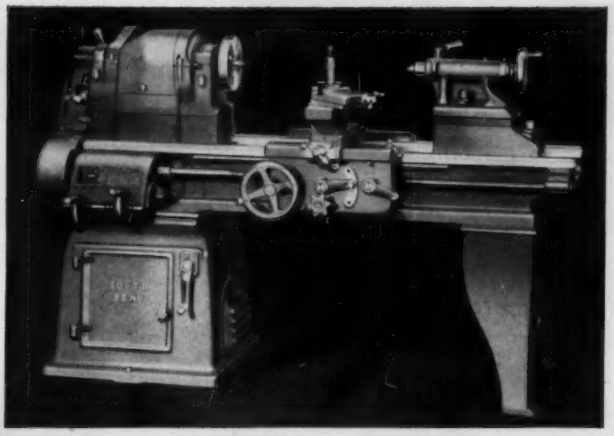

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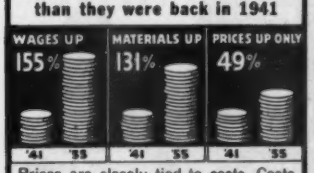

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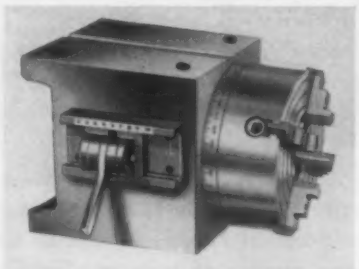

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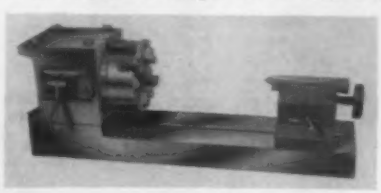

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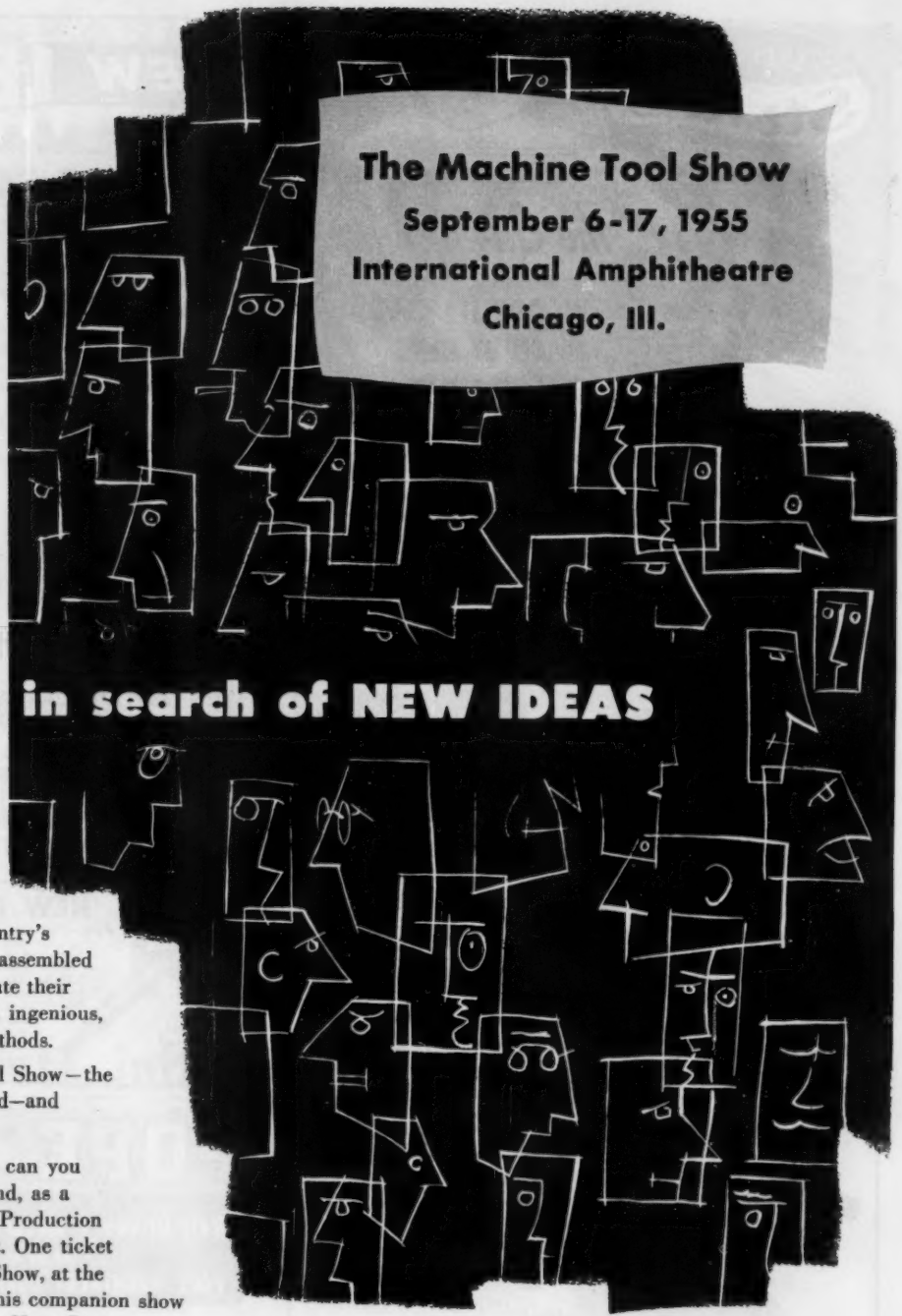

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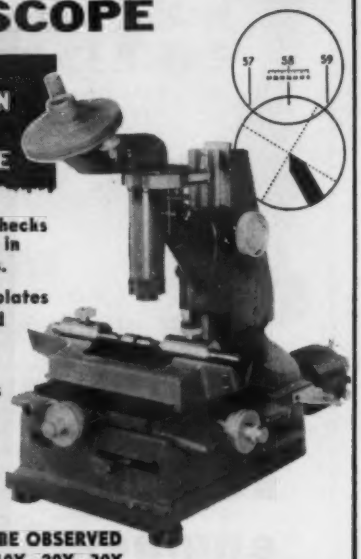

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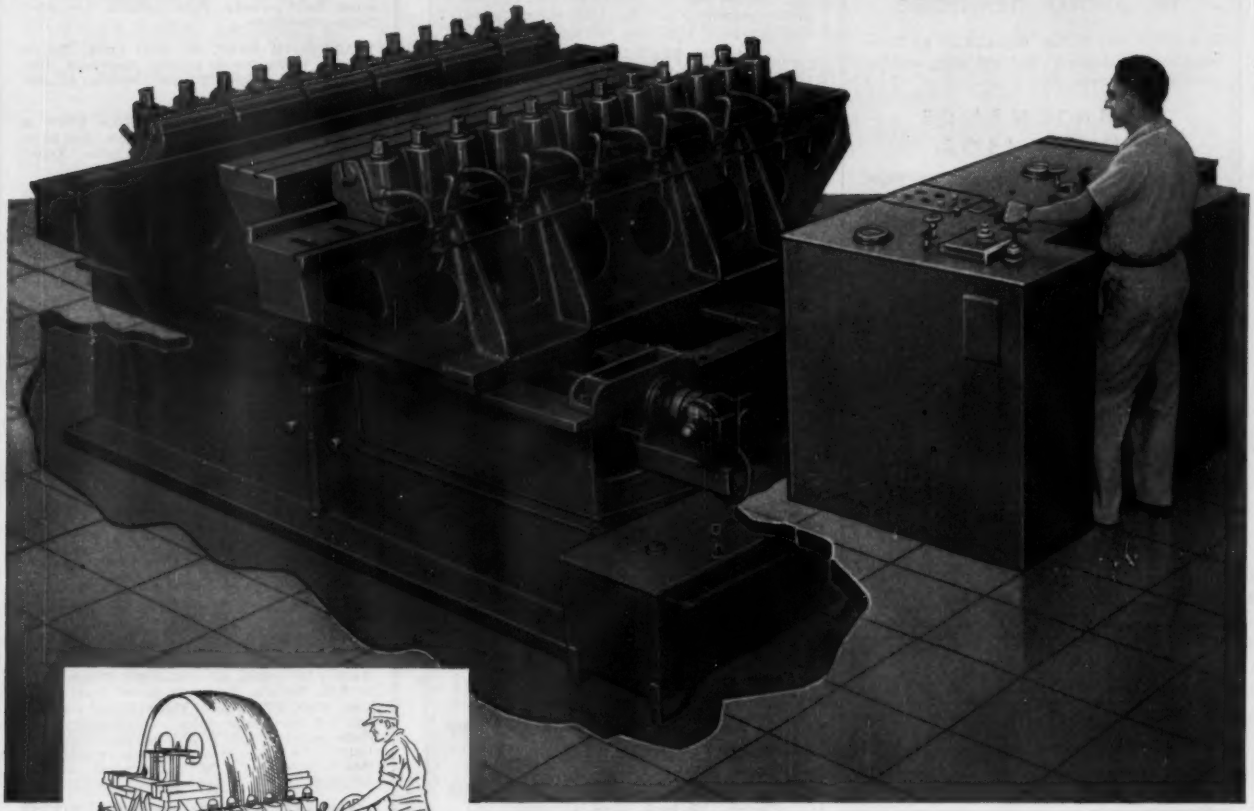

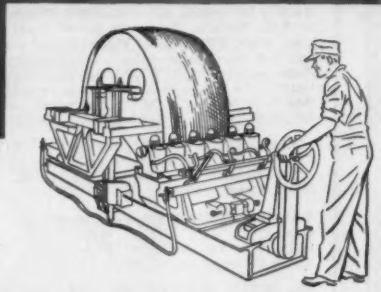

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LELAND-GIFFORD 2LMS, 2-spindle, M.D.; late
LELAND-GIFFORD 2LMS, 4-spindle, M.D.; late
NATCO B-4-B "Hole Steel" 60 adj. spindles; late
NATCO B-3-B "Hole Steel" 12 adj. spindles; late
NATCO E-5 high speed, 10 adj. spindles; late

FELLOWS GEAR EQUIPMENT
FELLOWS No. 6 High Speed Gear Shaper; late
FELLOWS No. 48 High Speed Gear Shaper; Internal cap. 72" diameter; late type
FELLOWS No. 6IA & 6I5A High Speed Gear Shaper
FELLOWS No. 672 High Speed Gear Shaper; late
FELLOWS No. 7A, No. 72 and No. 75 High Speed Gear shaper; late type
FELLOWS No. 13 LS Lapper; motor drive, late
FELLOWS 20-M Red Liner; New 1954
FELLOWS 24-M Involute Measuring Machine; 1954

GLEASON GEAR EQUIPMENT
GLEASON 3" Spiral Gear Generator; late type
GLEASON No. 7 Hyp. Cutter Sharp; latest type
GLEASON No. 13 Hyp. Cutter Sharp; latest type
GLEASON 12" Spiral Bev. Cutter Sharpener; M.D.
GLEASON 12" Straight Bevel Generator; late type
GLEASON No. 14 Spiral Bevel Hyp. Gear Grinder
GLEASON #16 Hypoid Gear Generator, motor drive.
GLEASON No. 17 Spiral Bevel, Zerol and Hypoid Gear Grinder, M.D., late type
GLEASON No. 18 Gear Tester and Lapper; M.D.
GLEASON No. 20 Spur Gear Tester; latest type
GLEASON #22 Hypoid Formate Gear Finisher; late
GLEASON 25" Straight Bevel Gear Gen.; M.D.
GLEASON 24" and 37" Bevel Gear Planer; M.D.
GLEASON 25" Spiral Bevel Gear Gen.; M.D.
GLEASON No. 6 Revacycle 5" cone distance; late

GRINDERS, Cyl. Plain & Univ.
BROWN & SHARPE #3 Univ. motor drive, late type
CINCINNATI 14"x72" Universal; M.D., late type
CINCINNATI 6"x18" Mod ER Plain, "Filmatic"; late
CINCINNATI #2 Centerless, Model EA Filmatic; late
LANDIS 20"x144" Plain Cyl. gap type, M.D., late
LANDIS 4"x12" Type H Hydraulic; late type
LANDIS 10"x18" type C Plain, Hydraulic, late
LANDIS 10"x36" type DC plain hydr. with infeed; late
LANDIS 16"x36" type "C" Universal, motor drive; late type
LANDIS 20"x144" Plain Gap Grinder; late type
NORTON 4"x12" Model CTU Plain, year 1953
NORTON 6"x18" Type "C" Plain; late type
NORTON 10"x48" Type C Hydr. Plain Cyl; late type
NORTON 16"x72" Type "C" Plain; late type

LATHES, Turret
GISHOLT #1L and #2L Saddle type; Timken; late
GISHOLT #3 Universal ram type; M.D., late type
LIBBY #4H, 12" hole, motor drive, late type
MOREY #2, #3, #4, #5, ram type; Timken; latest
WARNER & SWASEY #1-A Universal; Hex., late
WARNER & SWASEY #2 Geared Head; late type

LATHES, Engine & Mfg.
AMERICAN 16"x102" centers, "Pacemaker"; late type
GISHOLT #12 Hydraulic Automatic; motor drive; late
HENDEY 24"x36" centers; motor drive; late type
HENDEY 16"x72" centers Yoke Head, M.D., late type
LeBLOND 20"x48" centers, Timken; M.D., late type
LeBLOND 42"x108" centers, Timken; M.D., late type
LODGE & SHIPLEY 12"x30" centers, Toolroom
LODGE & SHIPLEY 14"x30" centers; late type
MONARCH Model EE 10"x20" centers, Toolroom; late
MONARCH 12"x30" centers; Model CKK; late type
MONARCH 16"x54" Centers, Motor Drive
MONARCH 16"x78" centers, Model CW, Timken, late
MONARCH 16"x78" c.c. Model CW; Timken; late type
MONARCH 20" (raise to 31½") x 144" c.c., late type
NILES 30"x50' bed, single and boring, "Time Saver"
NILES 30"x108" c.c. Geared Head; Timken; late
NILES 36"x100" centers "Time Saver"; motor drive
PRATT & WHITNEY 16"x30" centers; Timken, late
SPRINGFIELD 20"x40" c.c., motor drive; late type
SUNDSTRAND 10"x60" centers; auto Type B; late

MILLING MACHINES, Plain
BROWN & SHARPE #2 M.D. late type
BROWN & SHARPE #10, motor drive; late type
CINCINNATI 1-18 Production; Timken; late type

MILLING MACHINES, Thread
HALL Style "D" Planetary; late type
LEES BRADNER Model #LT 6"x30" and 8"x72"; #HT 12"x24" and #HT 12"x36" centers; late type
MOREY 12"x30" and 12"x160" centers; late type

MILLING MACHINES, Universal
CINCINNATI #3 Dial Type, Timken, M.D., late
VAN NORMAN #22L, and #36 ram type; late

MILLING MACHINES, Vertical
CINCINNATI #4 High Speed Dial type; late
CINCINNATI 0-8 Vertical; Timken; late type
CINCINNATI #3 Dial Type; High Speed, New 1953
KEARNEY & TRECKER #3K, late type

PLANERS
GRAY 48"x48"x10' "Maximum Service" 4 hds; PRT; DC; Reversing, Late type
LIBERTY 144"x76"x48" adj. openside; hex table; 4 hds; vari-voltage; PRT; New 1940
NILES-BEMENT-POND 72"x72"x30"; 4 hds; PRT; DC; M.D.

PRESSES
AVEY No. 2, 2-spindle Drill Press; late type
BLISS #410A, 825-ton double action toggle drawing press; M.D.
NATIONAL #5 "Maxi-Press", 1000-ton cap. H.S. Forging Machine; M.D.
SHAW 250-ton Hydraulic flanging press; late type
WATERBURY FARREL #9, 125-ton cap., M.D.

SHAPERS
CINCINNATI 20"; motor drive; late type
GOULD & EBERHARDT 32"; High Speed; M.D.
HENDEY 12" High Speed Univ. Crank Shaper; late
MOREY 8" Vertical; motor drive; late type
ROCKFORD 24", hydraulic motor drive; late type.

MISCELLANEOUS
ALEXANDER #2, 3-dim. Engraving NEW 1952
BARNES No. 172 Honing; M.D., hydr.; late type
HILLES & JONES #7 Plate Bending Roll; capacity ⅞" x 16"; motor drive
LeBLOND No. 2 Deep Hole Reaming, late type
LeBLOND No. 2 Deep Hole Rifling, late type
MANVILLE No. 3 Bolt Head Trimmer, M.D.
MANVILLE No. 1 Screw Slotter, Motor Drive
HUGH SMITH cap. 1" thick plate x 25' between housings-Plate Bend. Roll, M.D.

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24", 36", 42" BULLARD Vertical Turret Lathes, New Era, Turret Hd., Side Hd. M.D.

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No. 2, 4, 5 WARNER & SWASEY Geared Head Turret Lathes, Bar Feed.

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No. 7 BARDONS & OLIVER Universal Turret Lathe, 2½" capacity. Preselector Head.

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No. 2-18 CINCINNATI Plain Auto. M.D., Late

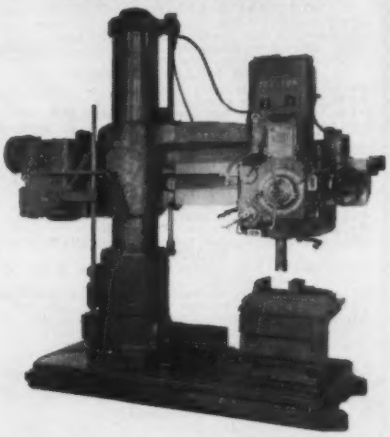
No. 2 BROWN & SHARPE Vert. Mill, Light Type, Swivel Head, M.D., Late.

No. 1-8 KENTS OWENS Hydraulic Horiz. Mill, Late Type, M.D.

6' arm x 17" column FOSDICK Economax Hydraulic Radial Drill, Motor on arm, late type. 1944

6' arm x 19" col. CARLTON Radial Drill, 20 HP., late type. 1943

DRILLING MACHINES



4' ARM, 15" COLUMN CARLTON RADIAL DRILL. 48 SPINDLE SPEEDS 15-1500 RPM. MOTOR ON ARM. 1943.

No. 262 BARNES Motor Driven Sliding Drill Press, 2" cap. in steel, 1941.

No. 2 M. T. Six Spindle ALLEN Type KH Drill Press, Individual Motor Drive, Late Type.

400 tons CHAMBERSBURG Hydraulic Wheel Press, 14" Ram, 96" between Tie Bars, 12' to End Support. M.D.

No. 0, 1, 2 BUFFALO FORGE Vertical Angle Bending Rolls, M.D.

#21½ BLISS O.B.I. Press, 56 tons cap., M.D.

No. 6 FEDERAL O.B.I. Press, 65 tons, cap., single geared, 4" stroke, M.D.

½, 1½ BUFFALO FORGE Universal Ironworker, Notcher and Coper, M.D.

T-56 VERSON Power Press Brake, 8' overall, late type, 100 tons cap., 1942.

No 20 WATERBURY FARREL Thread Roller, ⅜" cap. 1944, Motor Driven.

No. 8LS FELLOWS M.D. Gear Lapping Machine. Detachable Head, Univ. Work Support.

No. 00G BROWN & SHARPE High Speed Automatic Screw Machine. M.D. Late type.

10"x10" RACINE #30-C Hydraulic Heavy Duty Shear Cut Power Hack Saw, 1946.

10' x 10 ga., 10' x ¼" WYSONG & MILES Power Squaring Shears, Motor Driven.

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6" x 18" LANDIS Type "C" M.D. Hyd. Cylindrical Grinder, Serial #29196.

28" ROCKFORD Hy-Draulic Shaper, Vise, Late.

#TG615 JONES & LAMSON Thread Grinder, Lathe, M.D. and TG848.

No. 208 BESLEY Motor Driven Disc Grinder, 26" wheels, Late Type.

No. 194 BARNES Vertical Hone, 4" capacity, 12" stroke, Motor Driven.

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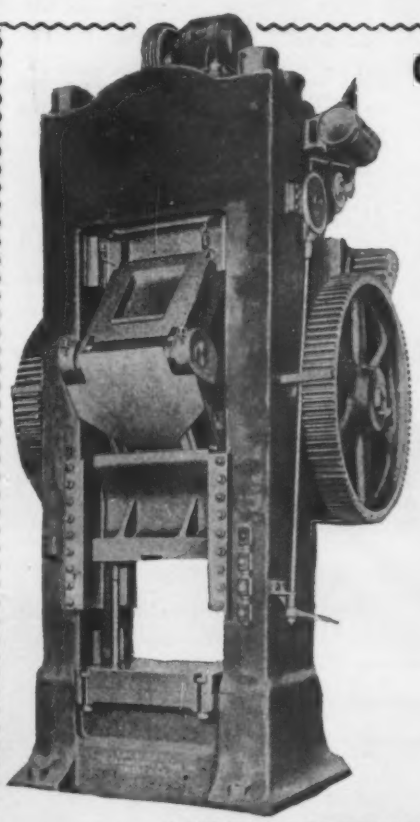

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3" Bar Yoder, Table Type, 1943
4½" bar Sellers Floor Type
RADIAL DRILLS, 5'15" col. Amer., Motor-an-Arm
No. 72A3 Heald Int., Late
12"x48" Landis Univ. "C" Hyd.
GEAR SHAPERS, Nos. 645A3, 61A & 61 Fellows
KEYSEATERS, Nos. 6A, 5, 4, & 2 M. & M.
LATHES, 16" x 154" Con. Hendey, T.A., Tim.
20"-32"x168" Con. Amer. Pacemaker, '49
MILLERS, No. 4S Cincl. Univ., Vert. Attach.
No. 3H Hor. & 4H Vert. K. & T.
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36" Rockford Hyd. 1942

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Gleason 3" Str. Bevel Gear Gen.
P & W 30" Vert. Profiler, 2-spindle.
V & O No. 302 Trimmer, 1947.

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3" bar Yoder table type, new 1942.
No. 2 Pratt & Whitney Jig Borer, Serial 323.
42" Bullard New Era vertical T/L
36" Rogers vert. T/L side head, new 1942

DRILLS, RADIAL

4' arm 13" col. Fosdick Economax, new 1941.
4' arm 13" col. Carlton M.O.B.
9 ft. arm 16" column American, late type

GRINDERS

4"x18" Cincinnati pl. hyd., plunge cut, 1946
6"x18" Landis "C", 30 deg. head, 1941
10"x18" Cincinnati Hmatic, type ER (2), 1941-1946
12"x36" Cincinnati ER Univ. cylindrical, new 1941.
14" Standard Electric twin-wheel carbide grinder, late.
14"x36" Landis type C, hydraulic (2), 1946
16"/26"x72" Norton type C, hydraulic, 1945
16"/40"x120" Landis gap type, hydraulic, serial 16193
12" Model 22 Heald rotary surface, 1942
16A2 Blanchard rotary surface, serial 6046, 1946
14"x36" Pratt & Whitney vertical surface grinder, 1942.
72" No. 72 Hanchett rotary surface, 1946

LATHES, ENGINE

10"x18" Hendey toolroom, serial 29620
12"x30" Monarch model C, ser. CK16407, 1942
24"x48" Monarch toolroom, serial CK-14677, 1942
14"x42" Hendey G.H., M.I.B., 1940
24"x14 ft. bed American G.H., G.C.G., serial 46070
24"x20' bed LeBlond heavy duty, DC motor, older
54"x30' bed Pond, DC motors, older but excellent

LATHES, MFG. & MISC. & TURRET

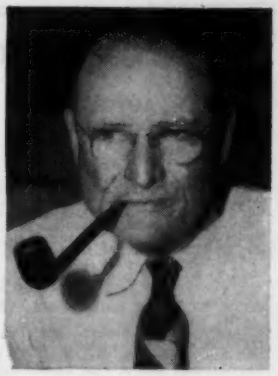
No. 3 Jones & Lamson, preselector head T/L, new 1940.
No. 5 Gisholt, pre-selector head, 1942
13"x30" Lips Carbo-Matic, 1942
17"x72" LeBlond Rapid production (5), 1946-1947
No. 5 Jones & Lamson Universal ram type turret lathes, (2) late models

MILLING MACHINES

No. 2 Cincinnati HI-Power plain horizontal
No. 4 Cincinnati HI-power plain horizontal
No. 5 Cincinnati HI-power plain horiz., vert. attach.
No. 4-36 and 4-48 Cincinnati Hydromatic production
No. 3B and 4K Kearney & Trecker plain, late type
No. 3B Brown & Sharpe plain horizontal, new 1942
No. 3K Kearney & Trecker universal dial type.
No. 3H Kearney & Trecker plain horiz., new 1942.

PRESSES

600 Ton No. 90-600 Minster K-J Coining, new 1941.
500 Ton Baldwin Southwark Hyspeed Hydraulic 1939
1000 Ton No. 666 Toledo Forging
105 Ton No. 7½ Verson O.B.I. (2)
150 ton No. 13-1 Cleveland O.B.I. late type
300 ton No. 1039 Hamilton S.A., D.C.
400 ton No. 603 Toledo knuckle joint
106 Ton No. 93C Toledo SS, DC air cushion
2 to 70 ton Ferracute punching (several)
3 to 60 ton O.B.I., most every make



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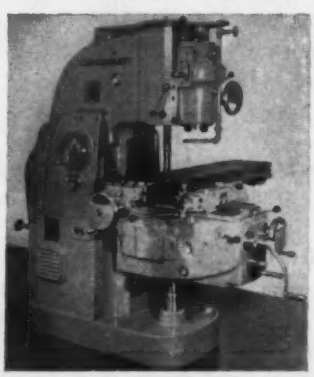

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42" Bullard V.T.L.
100" Niles Vert. Bor. Mill

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No. 2 Avey Cam Fd.—1 spdl.—15" sw.
No. 2MA6 Avey—1 spdl.—24" sw.
No. 2LMS L-G—2 spdl.—20" sw.
No. 2MS Allen—3 spdl.—24" sw.
No. LBM L-G—3 spdl.—20" sw.
No. 3 Avey—2 spdl.—24" sw.
No. K60H Fox Multiple

GEAR MACHINES

11" Gleason Gear Generator
No. 36BM Gould & Eberhardt
No. 615A Fellows Gear Shaper
No. 612A Fellows Gear Shaper
No. 65 Fellows, Cone Drive
No. 12HS Gould & Eberhardt

GRINDERS

No. 4H—4"x12" Landis Plain Cyl.
5"x36" Norton Cam-O-Matic
5"x42" Norton Type C Pl.
6"x18" Norton Type C Plain
8"x15" Elgin EB-5C
10"x18" Norton Type C Pl. Cyl.
10"x36" Norton Type C
10"x36" Norton Type C Cam Gdr.
14"x48" Landis Type C Plain
14"x72" Landis Univ.
16"x36" Norton Type C Pl.
16"-26"x72" Norton Pl.
18"x120" Norton Type A Plain
20"x192" Norton Type A Plain
24"x264" Norton Type A Plain
26"x72" Norton Pl.
No. TG615 J. & L. Thread Grinder
No. 81 Heald Int. Centerless
No. 74 Heald Int. Centerless
No. 72-A Heald Univ. Int.
No. 72A5 Heald Int. (1942)
No. 5 Bryant Internal
No. 5A Bryant Hole & Face
No. 5B Bryant Internal
No. 16-16 Bryant Internal
No. 16-28 Bryant Internal
No. 16A16 Bryant
No. 16A-28 Bryant Internal
No. 16F-28 Bryant Internal
No. 16-32 Bryant Internal
No. 24-26 Bryant Internal
No. 24-36 Bryant Internal
No. 24L-36 Bryant Internal
No. B24—25" chuck Arter Surf.
No. 214 Besly Dbl. End Disc
#8 Badger Hanchett Double End Disc.
Hill-Clarke Cyl. Norton Type M.D.
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No. 5W Acme Universal
No. 6 Warner & Swasey, bar fd.
No. 7A Jones & Lamson
No. 2A Warner & Swasey
3A Warner & Swasey Turret (1942)
No. 3AL Gisholt Cross Slide
No. 3H-10 Libby International
No. 3A Warner & Swasey Turret Lathe
No. 4A Warner & Swasey M.D.
No. 4A Warner & Swasey (1944)

FULL MONEY-BACK GUARANTEE

MILLING MACHINES

No. 2HL K. & T. Milwaukee Plain
No. 4 Cincinnati Dial Type Plain
No. 08 Cincinnati Vertical
No. 3K K. & T. Milwaukee Vert.
No. 4H K. & T. Milwaukee Vert.
118 Van Norman Hyd. Mfg. (1942)
Model A Briggs Mfg.
54"x30"x16' Ingersoll Slab
16"x60" Pratt & Whitney Thread
12"x102" HT Loss-Bradner Thread
No. 118 Van Norman Hyd. Mfg. Mill

PLANERS

48"x36"x14' Gray
60"x48"x27' American, 4 heads

MISCELLANEOUS

8 Spdl.—6" Goss & DeLeeuw Chucker
No. 56 Sundstrand Double End Cent. Mach.
15" Dill Slotter
18" Dill Slotter
Model 200 Micromatic Hor. Hone
Model H-7 Micromatic Vert. Hone
No. 224 Barnes Vertical Hone
No. 306 Barnes Vertical Hone
No. 6 B. & K. Straight Side Press
42"-ga. Economy Shear, M.D.

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14" Fay Flanders Type, m.d.
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Model B—1-1/16" Cleveland, m.d.
Model A—1⅜" Cleveland Single Spindle, late
4 spindle 1⅜" Cleveland Model M, m.d.
No. 5 DLX Potter & Johnston, m.d., late
No. 6 DRELX Potter & Johnston, m.d., later type
Model A—2" Cleveland Sinale Spindle, late
2½" Cleveland, m.d., Model A

BOLT THREADERS

Victor Nut Facing Machine, m.d., cap. ⅜" to 2" nuts
1" Landis Double Spindle, m.d. thru gear box
1½" Landis 2 spindle, late
1½" Landis 2 spindle, older type
No. 326 Oster Bolt & Pipe Thread Machine, m.d.

HORIZONTAL BORING MILLS

#7 Barrett Horizontal Boring Machine
3A Universal Horizontal Boring Mill, m.d.
25T Giddings & Lewis, m.d., late
No. 32 Lucas, m.d.
Barrett Double End, 7" and 5" spindles, m.d.
5½" bar Betts Floor Type, m.d.
5½" bar Niles-Bement-Pond, m.d.
6" bar Newton No. 2 Cylinder Borer, m.d.
10" bar Sellers Floor Type, m.d.
Floor Plates— all sizes

VERTICAL BORING MILLS

24" Bullard, 1943
36" Bullard, m.d.
53" Niles Heavy Pattern, m.d., p.r.t.
42" Bullard Spiral Drive, m.d., 1942
42" Bullard New Era, m.d.
42" King, with side head and plain swivel head on rail, 1940
44" Putnam, m.d., p.r.t.
44" Niles, m.d., p.r.t.
48" Niles-Bement-Pond, Car Wheel Borer, m.d.
100" Niles Heavy, m.d., p.r.t.
102" Niles Wheel Turning Boring Mill
12' Niles, m.d., p.r.t.

BROACHING MACHINES

75 H.P. LaPointe Hydraulic Broach, m.d.
12x72" Thompson Automatic Flat Broach, m.d.
10 ton, 84" stroke Single Ram Vertical Surface LaPointe, m.d., late
Type SBD-42-6 American Vertical Hy. Dup. Broach
Type SBD-48-15 American Vertical Dual Ram Surface Hydr. Broach
Oilgear Hydraulic Broach, type XA, 54" stroke, m.d.

RADIAL DRILLS

2'-9" col. Foodick, m.d.
3'-9" col. Cincinnati-Bickford, m.d.
3'-13" col. Cincinnati Bickford Super-Service, m.d.
4'-11" col. Morris, m.d. on arm
5'-14" col. Carlton, m.d.
7'-16" col. American Triple Purpose, m.d.
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2 spindle No. 3MA6 Avey, High Speed, m.d.
2 spindle Avey, No. 2, 3 belted m.d., p.f.
3 spindle No. 2MA6 Avey High Speed, m.d.
2 spindle No. 2 Leland & Gifford High Speed, 8" overhang, m.d.
3 spindle Leland & Gifford #1LMS—High Speed, late, m.d.
3 spindle Leland & Gifford High Speed, Model 3MS, m.d.
4 spindle Leland & Gifford High Speed, m.d. on each spindle
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No. 924 Barnes Vertical Drilling, Boring & Facing & Reaming Machine
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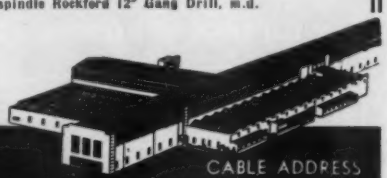

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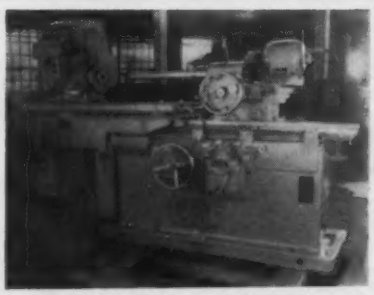

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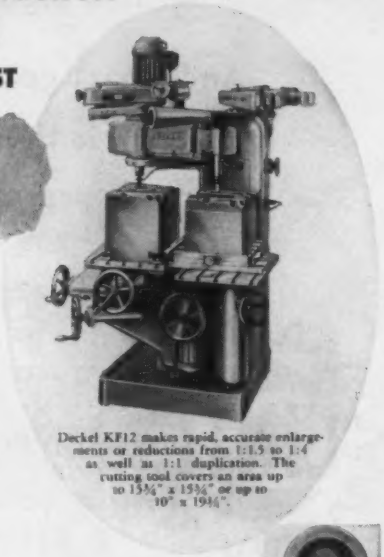

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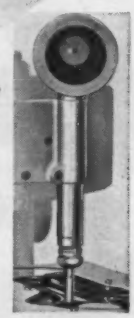

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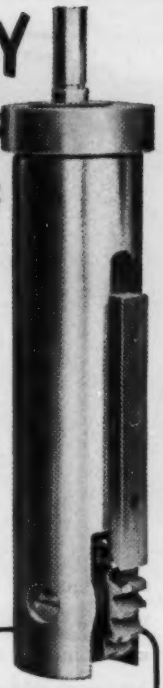

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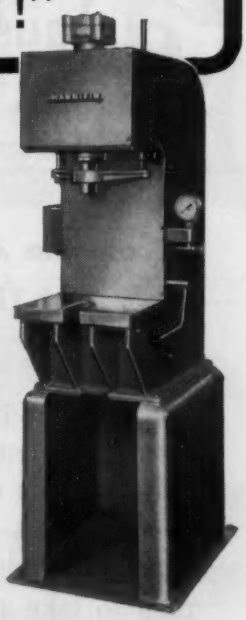

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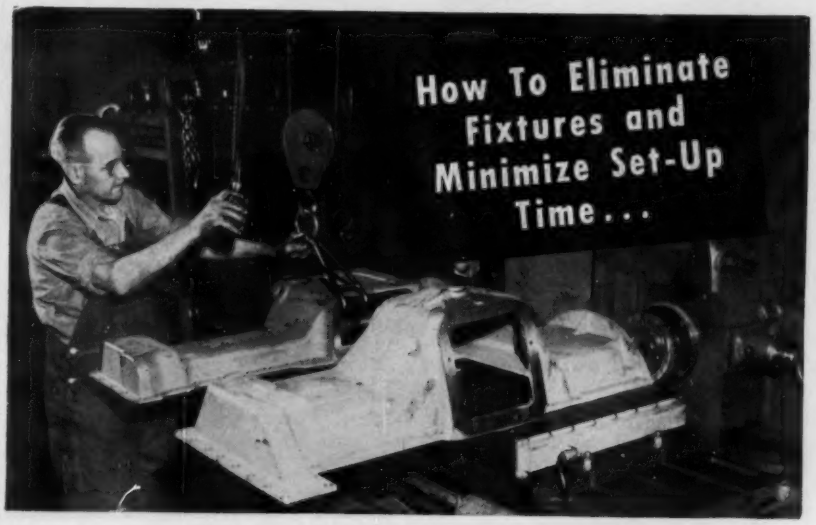

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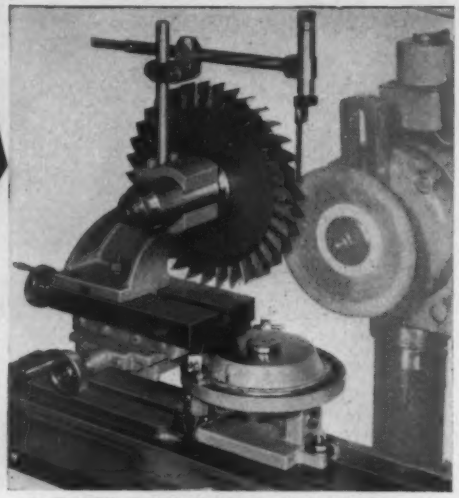

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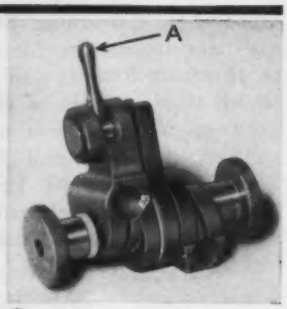

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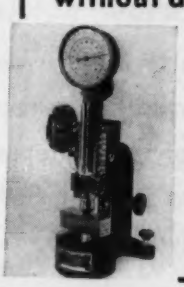

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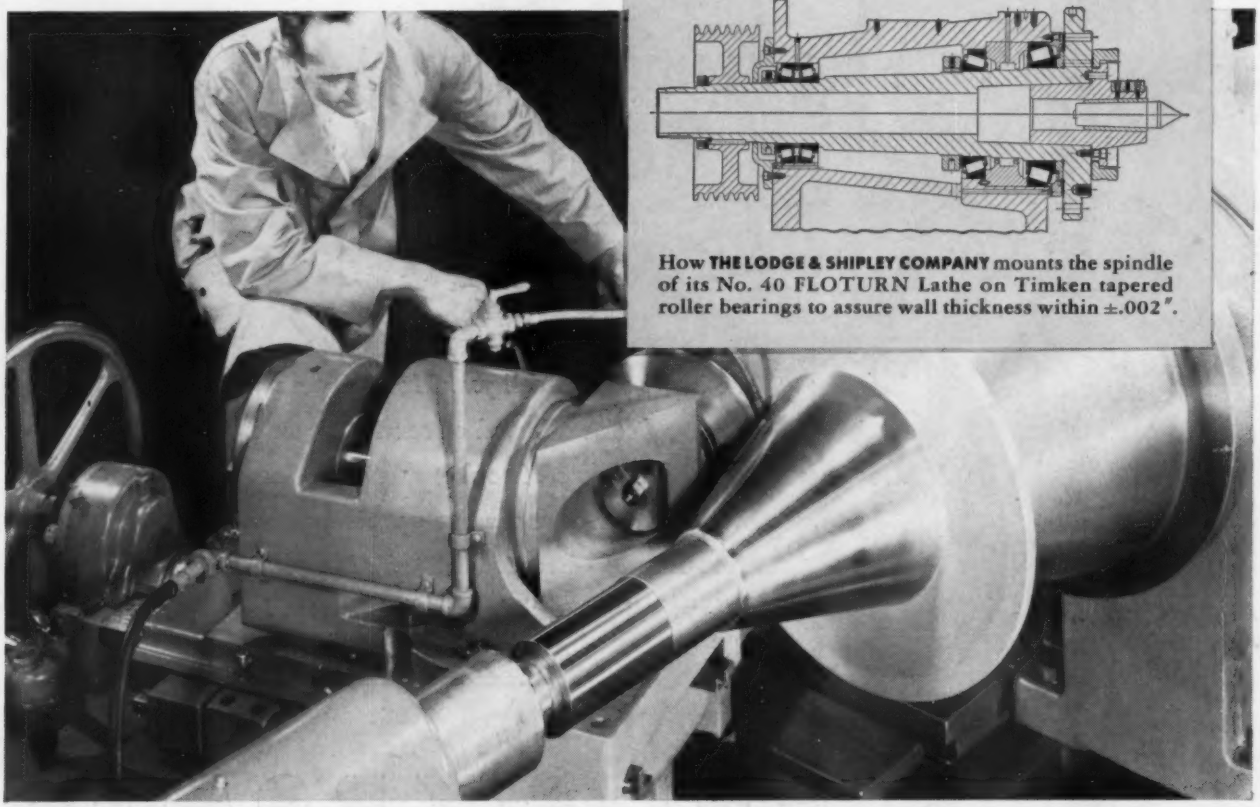
One big reason for this accuracy is the Timken® tapered roller bearings on the spindle. The tapered construction of Timken bearings lets them take the heavy radial and thrust loads in any combination—holds the spindle in rigid alignment. And line contact between the rollers and races of Timken bearings gives them extra load-carrying capacity — important since the metal is shaped by very high pressures.

Timken bearings practically eliminate friction, saving power. The geometrically correct design of Timken bearings gives them true rolling motion; their accuracy lives up to that design.

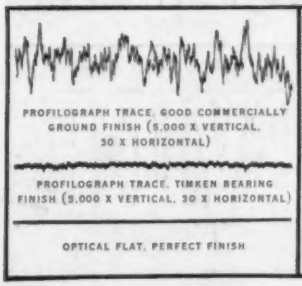
Under normal usage, Timken bearings last the life of the machine tool. One reason is that they're made of Timken fine alloy steel. We have to make the steel ourselves, because that's the only way we can completely control quality. No other U. S. bearing maker does it.

Whatever machine tool you build or buy, be sure it's equipped with Timken tapered roller bearings. Always look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



How **THE LODGE & SHIPLEY COMPANY** mounts the spindle of its No. 40 FLOTURN Lathe on Timken tapered roller bearings to assure wall thickness within ±.002″.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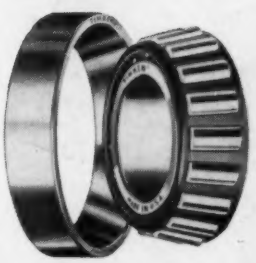

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